

Contents

1 rosininstall/catkin.rosinstall

```
1 - git:
2   local-name: skill_transfer
3   uri: https://github.com/lubiluk/skill_transfer.git
4   version: master
5 - git:
6   local-name: giskard_ros
7   uri: https://github.com/SemRoCo/giskard_ros.git
8   version: master
9 - git:
10  local-name: giskard_ros_utils
11  uri: https://github.com/SemRoCo/giskard_ros_utils.git
12  version: master
13 - git:
14  local-name: pysdf
15  uri: https://github.com/lubiluk/pysdf
16  version: shallow-search
17 - git:
18  local-name: gazebo2rviz
19  uri: https://github.com/lubiluk/gazebo2rviz
20  version: fixing
```

2 tasks/scrapping.yaml

```
1 name: Scrapping
2
3 required-object-info:
4   tool: true
5   target-object: true
6   task: scrapping_butter
7
8 # The following motion phases will be executed in a sequence
9 motion-phases:
10 - name: Position Above
11   # Giskard file
12   file: scrapping_position_above.yaml
13   # Stop conditions
14   stop:
15     # When measured gripper velocity drops below this threshold
16     measured-velocity-min-threshold: 0.002
17     # When desired (set by the controller) gripper velocity drops below this
18     threshold
19     desired-velocity-min-threshold: 0.002
20     # Stop on contact
21     contact: false
22     # Ignore stop conditions until the distance
23     # from the target configuration is less than this
24     activation-distance: 0.15
25 - name: Edge Contact
26   file: scrapping_edge_contact.yaml
27   stop:
28     measured-velocity-min-threshold: 0.002
29     desired-velocity-min-threshold: 0.002
30     contact: true
31     activation-distance: 0.15
32 - name: Scrape Off
33   file: scrapping_scrape_off.yaml
34   stop:
35     measured-velocity-min-threshold: 0.002
36     desired-velocity-min-threshold: 0.002
37     contact: false
38     activation-distance: 0.15
```

3 tasks/cutting.yaml

```
1  name: "Cutting"
2
3  required-object-info:
4    tool: true
5    target-object: false
6    task: cutting_lasagna
7
8  # The following motion phases will be executed in a sequence
9  motion-phases:
10   - name: "Position_Above"
11     # Giskard file
12     file: "cutting_position_above.yaml"
13     # Stop conditions
14     stop:
15       # When measured gripper velocity drops below this threshold
16       measured-velocity-min-threshold: 0.02
17       # When desired (set by the controller) gripper velocity drops below this
18       threshold
19       desired-velocity-min-threshold: 0.02
20       # Stop on contact
21       contact: false
22       # Ignore stop conditions until the distance
23       # from the target configuration is less than this
24       activation-distance: 0.15
25   - name: "Cut"
26     file: "cutting_cut.yaml"
27     stop:
28       measured-velocity-min-threshold: 0.002
29       desired-velocity-min-threshold: 0.002
30       contact: false
31       activation-distance: 0.15
32   - name: "Pull"
33     file: "cutting_pull.yaml"
34     stop:
35       measured-velocity-min-threshold: 0.02
36       desired-velocity-min-threshold: 0.02
37       contact: false
38       activation-distance: 0.15
```

4 tasks/tiltgrabbing.yaml

```
1 name: TiltGrabbing
2
3 required-object-info:
4   tool: true
5   target-object: true
6   task: grabbing_book
7
8 # The following motion phases will be executed in a sequence
9 motion-phases:
10 - name: Position Above
11   # Giskard file
12   file: tilting_position_above.yaml
13   # Stop conditions
14   stop:
15     # When measured gripper velocity drops below this threshold
16     measured-velocity-min-threshold: 0.02
17     # When desired (set by the controller) gripper velocity drops below this
18     # threshold
19     desired-velocity-min-threshold: 0.02
20     # Stop on contact
21     contact: false
22     # Ignore stop conditions until the distance
23     # from the target configuration is less than this
24     activation-distance: 0.15
25 - name: Position infront one
26   file: tilting_position_front.yaml
27   stop:
28     measured-velocity-min-threshold: 0.02
29     desired-velocity-min-threshold: 0.02
30     contact: false
31     activation-distance: 0.15
32 - name: Position infront two
33   file: tilting_position_front_2.yaml
34   stop:
35     measured-velocity-min-threshold: 0.02
36     desired-velocity-min-threshold: 0.02
37     contact: false
38     activation-distance: 0.15
39 - name: Touch top
40   file: tilting_touch_top.yaml
41   stop:
42     measured-velocity-min-threshold: 0.01
43     desired-velocity-min-threshold: 0.01
44     contact: true
45     activation-distance: 0.15
46 - name: Tilt
47   file: tilting_tilt.yaml
48   stop:
49     measured-velocity-min-threshold: 0.002
50     desired-velocity-min-threshold: 0.002
51     contact: false
52     activation-distance: 0.15
53 - name: Grab
54   file: tilting_grab.yaml
55   stop:
```

```
55     measured-velocity-min-threshold: 0.002
56     desired-velocity-min-threshold: 0.002
57     contact: false
58     activation-distance: 0.5
59 - name: Lift finger
60   file: tilting_position_above.yaml
61   stop:
62     measured-velocity-min-threshold: 0.002
63     desired-velocity-min-threshold: 0.002
64     contact: false
65     activation-distance: 0.15
66 - name: Pull
67   file: tilting_pull.yaml
68   stop:
69     measured-velocity-min-threshold: 0.002
70     desired-velocity-min-threshold: 0.002
71     contact: false
72     activation-distance: 0.15
```

5 tasks/scooping.yaml

```
1 name: "Scooping"
2
3 required-object-info:
4   tool: true
5   target-object: true
6   task: scooping_grains
7
8 # The following motion phases will be executed in a sequence
9 motion-phases:
10 - name: "Position_Above"
11   # Giskard file
12   file: "scooping_position_above.yaml"
13   # Stop conditions
14   stop:
15     # When measured gripper velocity drops below this threshold
16     measured-velocity-min-threshold: 0.02
17     # When desired (set by the controller) gripper velocity drops below this
18     # threshold
19     desired-velocity-min-threshold: 0.02
20     # Stop on contact
21     contact: true
22     # Ignore stop conditions until the distance
23     # from the target configuration is less than this
24     activation-distance: 0.15
25 - name: "Insert"
26   file: "scooping_insert.yaml"
27   stop:
28     measured-velocity-min-threshold: 0.02
29     desired-velocity-min-threshold: 0.02
30     contact: false
31     activation-distance: 0.15
32 - name: "Scoop"
33   file: "scooping_scoop.yaml"
34   stop:
35     measured-velocity-min-threshold: 0.02
36     desired-velocity-min-threshold: 0.02
37     contact: false
38     activation-distance: 0.15
39 - name: "Lift"
40   file: "scooping_lift.yaml"
41   stop:
42     measured-velocity-min-threshold: 0.02
43     desired-velocity-min-threshold: 0.02
44     contact: false
45     activation-distance: 0.15
```

6 experiments/scraping₁.yaml

```
1 name: Scraping Butter
2
3 # Object scans a.k.a. object knowledge base
4 tool-3d-scan: b_spatula.ply
5 target-object-3d-scan: b_big_bowl.ply
6
7 # Transformation from the end effector to the target object
8 tool-grasp:
9   frame:
10     - quaternion: [-0.0500550264148, 0.705614610626, 0.700932017793,
11       -0.0910868927763] # x, y, z, w
12     - vector3: [0.14, 0.028, -0.002] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16   frame:
17     - quaternion: [-0.171777970707, -0.685860866607, -0.0174027448572,
18       0.706954273563]
19     - vector3: [0.06, 0.11, 0]
20
21 # Task to execute a.k.a. motion knowledge base
22 task: scraping_butter.yaml
```


7 experiments/cutting₁.yaml

```
1 name: Cutting Lasagna
2
3 # Object scans a.k.a. object knowledge base
4 tool-3d-scan: iai_spatula.ply
5 target-object-3d-scan: iai_big_bowl.ply
6
7 # Transformation from the end effector to the target object
8 tool-grasp:
9   frame:
10     - quaternion: [-0.0500550264148, 0.705614610626, 0.700932017793,
11       -0.0910868927763] # x, y, z, w
12     - vector3: [0.14, 0.028, -0.002] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16   frame:
17     - quaternion: [-0.171777970707, -0.685860866607, -0.0174027448572,
18       0.706954273563]
19     - vector3: [0.06, 0.11, 0]
20
21 # Task to execute a.k.a. motion knowledge base
22 task: cutting_lasagna.yaml
```

8 experiments/scooping₁.yaml

```
1 name: Scooping Grains
2
3 # Object scans a.k.a. object knowledge base
4 tool-3d-scan: iai_spatula.ply
5 target-object-3d-scan: iai_big_bowl.ply
6
7 # Transformation from the end effector to the tool
8 tool-grasp:
9   frame:
10     - quaternion: [-0.0500550264148, 0.705614610626, 0.700932017793,
11       -0.0910868927763] # x, y, z, w
12     - vector3: [0.14, 0.028, -0.002] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16   frame:
17     - quaternion: [-0.171777970707, -0.685860866607, -0.0174027448572,
18       0.706954273563]
19     - vector3: [0.06, 0.11, 0]
20
21 # Task to execute a.k.a. motion knowledge base
22 task: scooping_grains.yaml
```

9 setups/book_{onshelf}4.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
4   target-object: book.ply
5
6 tool-mass: 0.05
7
8 # Transformation from the end effector to the tool
9 # need this as it is assumed left and right ee are gripping something
10 tool-grasp:
11   frame:
12     - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
13     - vector3: [0.0, 0.0, 0.0] # x, y, z
14
15 target-object-grasp:
16   frame: # the position of the corner of the book
17     - quaternion: [0.0, 0.0, 0.0, 1.0]
18     - vector3: [0.24, 0.860967, 0.681249] #[0.08415, 0, 0.3887]
19
20 object-width: 0.2
21
22 target-object-grasp-2:
23   frame:
24     - quaternion: [0.0, 0.0, 0.0, 1.0]
25     - vector3: [0.0, 0.0, 0.0]
```

10 setups/freezer_{box7}.yaml

```
1 point-clouds:
2   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
3   target-object: book.ply
4
5 tool-mass: 0.5
6
7 # Transformation from the end effector to the tool
8 # need this as it is assumed left and right ee are gripping something
9 tool-grasp:
10  frame:
11    - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
12    - vector3: [0.0, 0.0, 0.0] # x, y, z
13
14 target-object-grasp:
15   frame: # the position of the corner of the book
16    - quaternion: [0.0, -0.707, -0.0, 0.707]
17    - vector3: [0.14, 0.0, 0.2] #[0.08415, 0, 0.3887]
18
19 object-width: 0.2
20
21 target-object-grasp-2:
22  frame:
23    - quaternion: [0.0, 0.0, 0.0, 1.0]
24    - vector3: [0.0, 0.0, 0.0]
```

11 setups/*b_coffee_cup_bs_patula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_spatula.ply
4   target-object: b_coffee_cup.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.00253608,-0.708985,-0.705215,0.0025501] # x, y, z, w
12    - vector3: [0.146581,0.005236,-0.007987] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.127523,-0.986637,-0.100226,-0.0154688]
18    - vector3: [0.0284501,0.0346428,-0.0213798]
```

12 setups/*b_frying_pan_bk_nife.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_knife.ply
4   target-object: b_frying_pan.ply
5
6 tool-mass: 0.4
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.720776,0,0,0.693168] # x, y, z, w
12    - vector3: [0.090993,0.003448,-0.000959] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.130649,-0.693518,0.0126058,0.708382]
18    - vector3: [0.0186144,0.0468562,0.224672]
```

13 setups/ $b_{wildo}b_{owl}b_{thin}b_{patula}.yaml$

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_thin_spatula.ply
4   target-object: b_wildo_bowl.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.0256081,0.729689,-0.682751,0.0273691] # x, y, z, w
12    - vector3: [0.094321,0.007657,0.009274] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [0.705296,-0.0280521,-0.693065,0.146397]
18    - vector3: [0.0089419,0.0135799,0.0780419]
```

14 setups/book_{onshelf}8.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
4   target-object: book.ply
5
6 tool-mass: 0.05
7
8 # Transformation from the end effector to the tool
9 # need this as it is assumed left and right ee are gripping something
10 tool-grasp:
11   frame:
12     - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
13     - vector3: [0.0, 0.0, 0.0] # x, y, z
14
15 target-object-grasp:
16   frame: # the position of the corner of the book
17     - quaternion: [0.0, 0.0, 0.0, 1.0]
18     - vector3: [0.165, 0.860967, 0.581249] #[0.08415, 0, 0.3887]
19
20 object-width: 0.05
21
22 target-object-grasp-2:
23   frame:
24     - quaternion: [0.0, 0.0, 0.0, 1.0]
25     - vector3: [0.0, 0.0, 0.0]
```


15 setups/*b_{bucket}_{table}_{knife}.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_table_knife.ply
4   target-object: b_bucket.ply
5
6 tool-mass: 0.12
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.723185,0,0,0.690655] # x, y, z, w
12    - vector3: [0.060878,-0.002438,0.005864] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.0216269,-0.756025,-0.121089,-0.642881]
18    - vector3: [0.0577053,0.0189525,0.101375]
```

16 setups/*b_{red}m_{ug}b_kn_if_e.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_knife.ply
4   target-object: b_red_mug.ply
5
6 tool-mass: 0.4
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.720776,0,0,0.693168] # x, y, z, w
12    - vector3: [0.090993,0.003448,-0.000959] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [0.680965,-0.00654093,0.713979,0.162724]
18    - vector3: [-0.00780861,0.00428533,0.0614876]
```

17 setups/b_{pot}_{bs}patula.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_spatula.ply
4   target-object: b_pot.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.00253608,-0.708985,-0.705215,0.0025501] # x, y, z, w
12    - vector3: [0.146581,0.005236,-0.007987] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.130649,-0.693518,0.0126058,0.708382]
18    - vector3: [0.023942,0.0237816,0.132364]
```

18 setups/*b_{big}owl_{bt}hin_spatula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_thin_spatula.ply
4   target-object: b_big_bowl.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.0256081,0.729689,-0.682751,0.0273691] # x, y, z, w
12    - vector3: [0.094321,0.007657,0.009274] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.171777970707, -0.685860866607, -0.0174027448572,
18      0.706954273563]
19    - vector3: [0.06, 0.11, 0]
```

19 setups/ $b_{pot}b_{table_k}nife.yaml$

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_table_knife.ply
4   target-object: b_pot.ply
5
6 tool-mass: 0.12
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.723185,0,0,0.690655] # x, y, z, w
12    - vector3: [0.060878,-0.002438,0.005864] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.130649,-0.693518,0.0126058,0.708382]
18    - vector3: [0.023942,0.0237816,0.132364]
```

20 setups/freezer_{box}.yaml

```
1 point-clouds:
2   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
3   target-object: book.ply
4
5 tool-mass: 0.5
6
7 # Transformation from the end effector to the tool
8 # need this as it is assumed left and right ee are gripping something
9 tool-grasp:
10  frame:
11    - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
12    - vector3: [0.0, 0.0, 0.0] # x, y, z
13
14 target-object-grasp:
15   frame: # the position of the corner of the book
16     - quaternion: [0.0, -0.707, -0.0, 0.707]
17     - vector3: [-0.02, 0.0, 0.5] #[0.08415, 0, 0.3887]
18
19 object-width: 0.9
20
21 target-object-grasp-2:
22   frame:
23     - quaternion: [0.0, 0.0, 0.0, 1.0]
24     - vector3: [0.0, 0.0, 0.0]
```

21 setups/*b_{big}owl_{bs}patula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_spatula.ply
4   target-object: b_big_bowl.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.0500550264148, 0.705614610626, 0.700932017793,
12      -0.0910868927763] # x, y, z, w
13    - vector3: [0.14, 0.028, -0.002] # x, y, z
14
15 # Transformation from the end effector to the tool
16 target-object-grasp:
17  frame:
18    - quaternion: [-0.171777970707, -0.685860866607, -0.0174027448572,
19      0.706954273563]
20    - vector3: [0.06, 0.11, 0]
```

22 setups/book_{onshelf}.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
4   target-object: book.ply
5
6 tool-mass: 0.05
7
8 # Transformation from the end effector to the tool
9 # need this as it is assumed left and right ee are gripping something
10 tool-grasp:
11   frame:
12     - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
13     - vector3: [0.0, 0.0, 0.0] # x, y, z
14
15 target-object-grasp:
16   frame: # the position of the corner of the book
17     - quaternion: [0.0, 0.0, 0.0, 1.0]
18     - vector3: [0.23415, 0.661, 0.86594] #[0.08415, 0, 0.3887]
19
20 object-width: 0.037
21
22 target-object-grasp-2:
23   frame:
24     - quaternion: [0.0, 0.0, 0.0, 1.0]
25     - vector3: [0.0, 0.0, 0.0]
```


23 setups/freezer_{box3}.yaml

```
1 point-clouds:
2   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
3   target-object: book.ply
4
5 tool-mass: 0.5
6
7 # Transformation from the end effector to the tool
8 # need this as it is assumed left and right ee are gripping something
9 tool-grasp:
10  frame:
11    - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
12    - vector3: [0.0, 0.0, 0.0] # x, y, z
13
14 target-object-grasp:
15   frame: # the position of the corner of the book
16    - quaternion: [0.0, -0.707, -0.0, 0.707]
17    - vector3: [-0.02, 0.0, 0.5] #[0.08415, 0, 0.3887]
18
19 object-width: 0.5
20
21 target-object-grasp-2:
22  frame:
23    - quaternion: [0.0, 0.0, 0.0, 1.0]
24    - vector3: [0.0, 0.0, 0.0]
```

24 setups/book_{onshelf}7.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
4   target-object: book.ply
5
6 tool-mass: 0.05
7
8 # Transformation from the end effector to the tool
9 # need this as it is assumed left and right ee are gripping something
10 tool-grasp:
11   frame:
12     - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
13     - vector3: [0.0, 0.0, 0.0] # x, y, z
14
15 target-object-grasp:
16   frame: # the position of the corner of the book
17     - quaternion: [0.0, 0.0, 0.0, 1.0]
18     - vector3: [0.19, 0.860967, 0.581249] #[0.08415, 0, 0.3887]
19
20 object-width: 0.05
21
22 target-object-grasp-2:
23   frame:
24     - quaternion: [0.0, 0.0, 0.0, 1.0]
25     - vector3: [0.0, 0.0, 0.0]
```

25 setups/*b_{red}m_{ug}bs_{patula}.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_spatula.ply
4   target-object: b_red_mug.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.00253608,-0.708985,-0.705215,0.0025501] # x, y, z, w
12    - vector3: [0.146581,0.005236,-0.007987] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [0.680965,-0.00654093,0.713979,0.162724]
18    - vector3: [-0.00780861,0.00428533,0.0614876]
```

26 setups/*b_{big}owl_{b_serving}spoon.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_serving_spoon.ply
4   target-object: b_big_bowl.ply
5
6 tool-mass: 0.06
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.636851429939, 0.0316718295217, 0.0261988528073,
12      0.769890606403] # x, y, z, w
13    - vector3: [0.112571612, 0.00813051871955, -0.0153673645109] # x, y, z
14
15 # Transformation from the end effector to the tool
16 target-object-grasp:
17  frame:
18    - quaternion: [-0.171777970707, -0.685860866607, -0.0174027448572,
19      0.706954273563]
20    - vector3: [0.06, 0.11, 0]
```

27 setups/*b_{red}m_{ug}bt_{able}_kni_{fe}.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_table_knife.ply
4   target-object: b_red_mug.ply
5
6 tool-mass: 0.12
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.723185,0,0,0.690655] # x, y, z, w
12    - vector3: [0.060878,-0.002438,0.005864] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [0.680965,-0.00654093,0.713979,0.162724]
18    - vector3: [-0.00780861,0.00428533,0.0614876]
```

28 setups/*b_coffee_cup_bk_nife.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_knife.ply
4   target-object: b_coffee_cup.ply
5
6 tool-mass: 0.4
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.720776,0,0,0.693168] # x, y, z, w
12    - vector3: [0.090993,0.003448,-0.000959] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.127523,-0.986637,-0.100226,-0.0154688]
18    - vector3: [0.0284501,0.0346428,-0.0213798]
```

29 setups/freezer_{box2}.yaml

```
1 point-clouds:
2   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
3   target-object: book.ply
4
5 tool-mass: 0.5
6
7 # Transformation from the end effector to the tool
8 # need this as it is assumed left and right ee are gripping something
9 tool-grasp:
10  frame:
11    - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
12    - vector3: [0.0, 0.0, 0.0] # x, y, z
13
14 target-object-grasp:
15   frame: # the position of the corner of the book
16    - quaternion: [0.0, -0.707, -0.0, 0.707]
17    - vector3: [-0.02, 0.0, 0.5] #[0.08415, 0, 0.3887]
18
19 object-width: 0.5
20
21 target-object-grasp-2:
22  frame:
23    - quaternion: [0.0, 0.0, 0.0, 1.0]
24    - vector3: [0.0, 0.0, 0.0]
```

30 setups/book_{onshelf}2.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
4   target-object: book.ply
5
6 tool-mass: 0.05
7
8 # Transformation from the end effector to the tool
9 # need this as it is assumed left and right ee are gripping something
10 tool-grasp:
11   frame:
12     - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
13     - vector3: [0.0, 0.0, 0.0] # x, y, z
14
15 target-object-grasp:
16   frame: # the position of the corner of the book
17     - quaternion: [0.0, 0.0, 0.0, 1.0]
18     - vector3: [0.24, 0.860967, 0.981249] #[0.08415, 0, 0.3887]
19
20 object-width: 0.5
21
22 target-object-grasp-2:
23   frame:
24     - quaternion: [0.0, 0.0, 0.0, 1.0]
25     - vector3: [0.0, 0.0, 0.0]
```


31 setups/*b_{bucket}_{b_k}knife.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_knife.ply
4   target-object: b_bucket.ply
5
6 tool-mass: 0.4
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.720776,0,0,0.693168] # x, y, z, w
12    - vector3: [0.090993,0.003448,-0.000959] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.0216269,-0.756025,-0.121089,-0.642881]
18    - vector3: [0.0577053,0.0189525,0.101375]
```

32 setups/*b_coffee_cup_b_serving_spoon.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_serving_spoon.ply
4   target-object: b_coffee_cup.ply
5
6 tool-mass: 0.06
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.636851429939, 0.0316718295217, 0.0261988528073,
12      0.769890606403] # x, y, z, w
13    - vector3: [0.112571612, 0.00813051871955, -0.0153673645109] # x, y, z
14
15 # Transformation from the end effector to the tool
16 target-object-grasp:
17   frame:
18     - quaternion: [-0.127523, -0.986637, -0.100226, -0.0154688]
19     - vector3: [0.0284501, 0.0346428, -0.0213798]
```

33 setups/freezer_{box4}.yaml

```
1 point-clouds:
2   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
3   target-object: book.ply
4
5 tool-mass: 0.5
6
7 # Transformation from the end effector to the tool
8 # need this as it is assumed left and right ee are gripping something
9 tool-grasp:
10  frame:
11    - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
12    - vector3: [0.0, 0.0, 0.0] # x, y, z
13
14 target-object-grasp:
15   frame: # the position of the corner of the book
16    - quaternion: [0.0, -0.707, -0.0, 0.707]
17    - vector3: [-0.02, 0.0, 0.5] #[0.08415, 0, 0.3887]
18
19 object-width: 0.2
20
21 target-object-grasp-2:
22  frame:
23    - quaternion: [0.0, 0.0, 0.0, 1.0]
24    - vector3: [0.0, 0.0, 0.0]
```

34 setups/ $b_{wildo}b_{owl}b_{table}b_{knife}.yaml$

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_table_knife.ply
4   target-object: b_wildo_bowl.ply
5
6 tool-mass: 0.12
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.723185,0,0,0.690655] # x, y, z, w
12    - vector3: [0.060878,-0.002438,0.005864] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [0.705296,-0.0280521,-0.693065,0.146397]
18    - vector3: [0.0089419,0.0135799,0.0780419]
```

35 setups/*b_{bucket}_{b_serving_spoon}.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_serving_spoon.ply
4   target-object: b_bucket.ply
5
6 tool-mass: 0.06
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.636851429939, 0.0316718295217, 0.0261988528073,
12      0.769890606403] # x, y, z, w
13    - vector3: [0.112571612, 0.00813051871955, -0.0153673645109] # x, y, z
14
15 # Transformation from the end effector to the tool
16 target-object-grasp:
17  frame:
18    - quaternion: [-0.0216269, -0.756025, -0.121089, -0.642881]
19    - vector3: [0.0577053, 0.0189525, 0.101375]
```

36 setups/ $b_{wildo}b_{owl}b_{knife}.yaml$

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_knife.ply
4   target-object: b_wildo_bowl.ply
5
6 tool-mass: 0.4
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.720776,0,0,0.693168] # x, y, z, w
12    - vector3: [0.090993,0.003448,-0.000959] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [0.705296,-0.0280521,-0.693065,0.146397]
18    - vector3: [0.0089419,0.0135799,0.0780419]
```

37 setups/*b_frying_pan_btable_knife.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_table_knife.ply
4   target-object: b_frying_pan.ply
5
6 tool-mass: 0.12
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.723185,0,0,0.690655] # x, y, z, w
12    - vector3: [0.060878,-0.002438,0.005864] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.130649,-0.693518,0.0126058,0.708382]
18    - vector3: [0.0186144,0.0468562,0.224672]
```

38 setups/*b_frying_pan_b_serving_spoon.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_serving_spoon.ply
4   target-object: b_frying_pan.ply
5
6 tool-mass: 0.06
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.636851429939, 0.0316718295217, 0.0261988528073,
12      0.769890606403] # x, y, z, w
13    - vector3: [0.112571612, 0.00813051871955, -0.0153673645109] # x, y, z
14
15 # Transformation from the end effector to the tool
16 target-object-grasp:
17  frame:
18    - quaternion: [-0.130649, -0.693518, 0.0126058, 0.708382]
19    - vector3: [0.0186144, 0.0468562, 0.224672]
```


39 setups/*b_{red}m_{ug}b_serving_spoon.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_serving_spoon.ply
4   target-object: b_red_mug.ply
5
6 tool-mass: 0.06
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.636851429939, 0.0316718295217, 0.0261988528073,
12      0.769890606403] # x, y, z, w
13    - vector3: [0.112571612, 0.00813051871955, -0.0153673645109] # x, y, z
14
15 # Transformation from the end effector to the tool
16 target-object-grasp:
17  frame:
18    - quaternion: [0.680965, -0.00654093, 0.713979, 0.162724]
19    - vector3: [-0.00780861, 0.00428533, 0.0614876]
```

40 setups/freezer_{box6}.yaml

```
1 point-clouds:
2   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
3   target-object: book.ply
4
5 tool-mass: 0.5
6
7 # Transformation from the end effector to the tool
8 # need this as it is assumed left and right ee are gripping something
9 tool-grasp:
10  frame:
11    - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
12    - vector3: [0.0, 0.0, 0.0] # x, y, z
13
14 target-object-grasp:
15   frame: # the position of the corner of the book
16    - quaternion: [0.0, -0.707, -0.0, 0.707]
17    - vector3: [0.14, 0.0, 0.5] #[0.08415, 0, 0.3887]
18
19 object-width: 0.2
20
21 target-object-grasp-2:
22  frame:
23    - quaternion: [0.0, 0.0, 0.0, 1.0]
24    - vector3: [0.0, 0.0, 0.0]
```

41 setups/book_{onshelf}5.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
4   target-object: book.ply
5
6 tool-mass: 0.05
7
8 # Transformation from the end effector to the tool
9 # need this as it is assumed left and right ee are gripping something
10 tool-grasp:
11   frame:
12     - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
13     - vector3: [0.0, 0.0, 0.0] # x, y, z
14
15 target-object-grasp:
16   frame: # the position of the corner of the book
17     - quaternion: [0.0, 0.0, 0.0, 1.0]
18     - vector3: [0.24, 0.860967, 0.681249] #[0.08415, 0, 0.3887]
19
20 object-width: 0.05
21
22 target-object-grasp-2:
23   frame:
24     - quaternion: [0.0, 0.0, 0.0, 1.0]
25     - vector3: [0.0, 0.0, 0.0]
```

42 setups/*b_{frying}pan_{bt}hin_spatula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_thin_spatula.ply
4   target-object: b_frying_pan.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.0256081,0.729689,-0.682751,0.0273691] # x, y, z, w
12    - vector3: [0.094321,0.007657,0.009274] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.130649,-0.693518,0.0126058,0.708382]
18    - vector3: [0.0186144,0.0468562,0.224672]
```

43 setups/*b_{red}_mug_{bt}hin_spatula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_thin_spatula.ply
4   target-object: b_red_mug.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.0256081,0.729689,-0.682751,0.0273691] # x, y, z, w
12    - vector3: [0.094321,0.007657,0.009274] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [0.680965,-0.00654093,0.713979,0.162724]
18    - vector3: [-0.00780861,0.00428533,0.0614876]
```

44 setups/*b_{big}owl_{bk}knife.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_knife.ply
4   target-object: b_big_bowl.ply
5
6 tool-mass: 0.4
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.720776,0,0,0.693168] # x, y, z, w
12    - vector3: [0.090993,0.003448,-0.000959] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.171777970707, -0.685860866607, -0.0174027448572,
18      0.706954273563]
19    - vector3: [0.06, 0.11, 0]
```

45 setups/*b_pot_b_serving_spoon.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_serving_spoon.ply
4   target-object: b_pot.ply
5
6 tool-mass: 0.06
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.636851429939, 0.0316718295217, 0.0261988528073,
12      0.769890606403] # x, y, z, w
13    - vector3: [0.112571612, 0.00813051871955, -0.0153673645109] # x, y, z
14
15 # Transformation from the end effector to the tool
16 target-object-grasp:
17   frame:
18     - quaternion: [-0.130649, -0.693518, 0.0126058, 0.708382]
19     - vector3: [0.023942, 0.0237816, 0.132364]
```

46 setups/*b_frying_pan_bs_patula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_spatula.ply
4   target-object: b_frying_pan.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.00253608, -0.708985, -0.705215, 0.0025501] # x, y, z, w
12    - vector3: [0.146581, 0.005236, -0.007987] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.130649, -0.693518, 0.0126058, 0.708382]
18    - vector3: [0.0186144, 0.0468562, 0.224672]
```


47 setups/Readme.md

```
1 This directory contains files that provide handcoded information to the robot:
2
3 * Grasps (how have I grasped objects)
4 * Object models (what is in my hands)
5 * Object info (edge, tip, etc.)
6
7 Ideally this should not be needed at all, because the robot should be able
8 to infer or recognize all such data about it's environment.
9
10 Note:
11 When object info is given then feature_detector will be bypassed.
12
13
14 Sample file:
15
16 '''
17 # Object scans a.k.a. object knowledge base
18 point-clouds:
19   tool: b_table_knife.ply
20   target-object: b_bucket.ply
21
22   tool-mass: 0.050
23
24   # Transformation from the end effector to the tool
25   tool-grasp:
26     frame:
27       quaternion: [0.723185, 0, 0, 0.690655] # x, y, z, w
28       vector3: [0.060878, -0.002438, 0.005864] # x, y, z
29
30   # Transformation from the end effector to the target object
31   target-object-grasp:
32     frame:
33       quaternion: [-0.0216269, -0.756025, -0.121089, -0.642881]
34       vector3: [0.0577053, 0.0189525, 0.101375]
35   '''
```

48 setups/freezer_{box}5.yaml

```
1 point-clouds:
2   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
3   target-object: book.ply
4
5 tool-mass: 0.5
6
7 # Transformation from the end effector to the tool
8 # need this as it is assumed left and right ee are gripping something
9 tool-grasp:
10  frame:
11    - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
12    - vector3: [0.0, 0.0, 0.0] # x, y, z
13
14 target-object-grasp:
15   frame: # the position of the corner of the book
16    - quaternion: [0.0, -0.707, -0.0, 0.707]
17    - vector3: [0.13, 0.0, 0.5] #[0.08415, 0, 0.3887]
18
19 object-width: 0.5
20
21 target-object-grasp-2:
22  frame:
23    - quaternion: [0.0, 0.0, 0.0, 1.0]
24    - vector3: [0.0, 0.0, 0.0]
```

49 setups/*b_{bucket}_{bt}hin_spatula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_thin_spatula.ply
4   target-object: b_bucket.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.0256081,0.729689,-0.682751,0.0273691] # x, y, z, w
12    - vector3: [0.094321,0.007657,0.009274] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.0216269,-0.756025,-0.121089,-0.642881]
18    - vector3: [0.0577053,0.0189525,0.101375]
```

50 setups/*b_coffee_cup_btthin_spatula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_thin_spatula.ply
4   target-object: b_coffee_cup.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.0256081,0.729689,-0.682751,0.0273691] # x, y, z, w
12    - vector3: [0.094321,0.007657,0.009274] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.127523,-0.986637,-0.100226,-0.0154688]
18    - vector3: [0.0284501,0.0346428,-0.0213798]
```

51 setups/*b_wildo_bowl_bspatula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_spatula.ply
4   target-object: b_wildo_bowl.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.00253608,-0.708985,-0.705215,0.0025501] # x, y, z, w
12    - vector3: [0.146581,0.005236,-0.007987] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [0.705296,-0.0280521,-0.693065,0.146397]
18    - vector3: [0.0089419,0.0135799,0.0780419]
```

52 setups/*b_coffee_cup_btable_knife.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_table_knife.ply
4   target-object: b_coffee_cup.ply
5
6 tool-mass: 0.12
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.723185,0,0,0.690655] # x, y, z, w
12    - vector3: [0.060878,-0.002438,0.005864] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.127523,-0.986637,-0.100226,-0.0154688]
18    - vector3: [0.0284501,0.0346428,-0.0213798]
```

53 setups/book_{onshelf}6.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
4   target-object: book.ply
5
6 tool-mass: 0.05
7
8 # Transformation from the end effector to the tool
9 # need this as it is assumed left and right ee are gripping something
10 tool-grasp:
11   frame:
12     - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
13     - vector3: [0.0, 0.0, 0.0] # x, y, z
14
15 target-object-grasp:
16   frame: # the position of the corner of the book
17     - quaternion: [0.0, 0.0, 0.0, 1.0]
18     - vector3: [0.24, 0.860967, 0.581249] #[0.08415, 0, 0.3887]
19
20 object-width: 0.05
21
22 target-object-grasp-2:
23   frame:
24     - quaternion: [0.0, 0.0, 0.0, 1.0]
25     - vector3: [0.0, 0.0, 0.0]
```

54 setups/*b_pot_b_knife.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_knife.ply
4   target-object: b_pot.ply
5
6 tool-mass: 0.4
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.720776,0,0,0.693168] # x, y, z, w
12    - vector3: [0.090993,0.003448,-0.000959] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.130649,-0.693518,0.0126058,0.708382]
18    - vector3: [0.023942,0.0237816,0.132364]
```


55 setups/*b_pot_btthin_spatula.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_thin_spatula.ply
4   target-object: b_pot.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.0256081,0.729689,-0.682751,0.0273691] # x, y, z, w
12    - vector3: [0.094321,0.007657,0.009274] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.130649,-0.693518,0.0126058,0.708382]
18    - vector3: [0.023942,0.0237816,0.132364]
```

56 setups/*b_{big}owl_{bt}able_kknife.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_table_knife.ply
4   target-object: b_big_bowl.ply
5
6 tool-mass: 0.12
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.723185,0,0,0.690655] # x, y, z, w
12    - vector3: [0.060878,-0.002438,0.005864] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.171777970707, -0.685860866607, -0.0174027448572,
18      0.706954273563]
19    - vector3: [0.06, 0.11, 0]
```

57 setups/*b_wildo_bowl_b_serving_spoon.yaml*

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_serving_spoon.ply
4   target-object: b_wildo_bowl.ply
5
6 tool-mass: 0.06
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [0.636851429939, 0.0316718295217, 0.0261988528073,
12      0.769890606403] # x, y, z, w
13    - vector3: [0.112571612, 0.00813051871955, -0.0153673645109] # x, y, z
14
15 # Transformation from the end effector to the tool
16 target-object-grasp:
17  frame:
18    - quaternion: [0.705296, -0.0280521, -0.693065, 0.146397]
19    - vector3: [0.0089419, 0.0135799, 0.0780419]
```

58 setups/b_{bucket_{bs}}patula.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: b_spatula.ply
4   target-object: b_bucket.ply
5
6 tool-mass: 0.11
7
8 # Transformation from the end effector to the target object
9 tool-grasp:
10  frame:
11    - quaternion: [-0.00253608,-0.708985,-0.705215,0.0025501] # x, y, z, w
12    - vector3: [0.146581,0.005236,-0.007987] # x, y, z
13
14 # Transformation from the end effector to the tool
15 target-object-grasp:
16  frame:
17    - quaternion: [-0.0216269,-0.756025,-0.121089,-0.642881]
18    - vector3: [0.0577053,0.0189525,0.101375]
```

59 setups/book_{onshelf}3.yaml

```
1 # Object scans a.k.a. object knowledge base
2 point-clouds:
3   tool: nothing.ply # no tool therefore no pointcloud, but still need pointcloud
4   target-object: book.ply
5
6 tool-mass: 0.05
7
8 # Transformation from the end effector to the tool
9 # need this as it is assumed left and right ee are gripping something
10 tool-grasp:
11   frame:
12     - quaternion: [0.0, 0., 0., 1.000000000001] # x, y, z, w
13     - vector3: [0.0, 0.0, 0.0] # x, y, z
14
15 target-object-grasp:
16   frame: # the position of the corner of the book
17     - quaternion: [0.0, 0.0, 0.0, 1.0]
18     - vector3: [0.24, 0.860967, 0.681249] #[0.08415, 0, 0.3887]
19
20 object-width: 0.5
21
22 target-object-grasp-2:
23   frame:
24     - quaternion: [0.0, 0.0, 0.0, 1.0]
25     - vector3: [0.0, 0.0, 0.0]
```

60 `srv/GetTaskSpec.srv`

```
1  ---  
2  int32 motion_phase_count
```

61 srv/DetectTargetObjectInfo.srv

```
1  string point_cloud_file_name
2  ---
3  geometry_msgs/Point edge_point
4  geometry_msgs/Vector3 alignment_vector
```

62 srv/GetMotionSpec.srv

```
1  int32 index
2  ---
3  string spec
4  StopCondition stop_condition
```


63 srv/DetectToolInfo.srv

```
1  string point_cloud_file_name
2  float64 tool_mass
3  string task_name
4  geometry_msgs/Point edge_point
5  geometry_msgs/Vector3 alignment_vector
6  ---
7  float64 affordance_score
8  geometry_msgs/Point grasp_center
9  geometry_msgs/Point action_center
10 geometry_msgs/Point tool_tip
11 geometry_msgs/Vector3 tool_tip_vector
12 geometry_msgs/Quaternion tool_quaternion
13 geometry_msgs/Point tool_heel
```

64 launch/experiment.launch

```
1 <launch>
2   <node pkg="skill_transfer" type="feature_detector" name="feature_detector"
3     output="screen">
4     <param name="point_cloud_directory_path" type="string" value="$(find_
5       skill_transfer)/point_clouds/" />
6     <param name="trained_data_directory_path" type="string" value="$(find_
7       skill_transfer)/trained_data/" />
8     <param name="show_results" type="boolean" value="true" />
9   </node>
10
11  <node pkg="skill_transfer" type="knowledge_manager" name="knowledge_manager"
12    output="screen">
13    <param name="task_file_path" type="string" value="$(find_ skill_transfer)/
14      tasks/$(arg task).yaml" />
15    <param name="motion_template_file_path" type="string" value="$(find_
16      skill_transfer)/motion_templates/$(arg robot).yaml"/>
17    <param name="motion_directory_path" type="string" value="$(find_
18      skill_transfer)/motions/" />
19    <param name="setup_file_path" type="string" value="$(find_ skill_transfer)/
20      setups/$(arg setup).yaml" />
21    <param name="info_cache_directory_path" type="string" value="$(find_
22      skill_transfer)/info_cache/" />
23  </node>
24
25  <node pkg="skill_transfer" type="constraint_controller_$(arg robot)" name="
26    constraint_controller" output="screen"/>
27
28  <node pkg="skill_transfer" type="task_executive" name="task_executive" output=
29    "screen"/>
30</launch>
```

65 launch/pr2.launch

```
1 <launch>
2   <group>
3     <include file="$(find iai_pr2_description)/launch/upload_pr2.launch" />
4
5     <node pkg="iai_naive_kinematics_sim" type="simulator"
6       name="simulator" output="screen">
7       <rosparam command="load"
8         file="$(find skill_transfer)/initial_poses/pr2_scraping.yaml" />
9       <remap from="~joint_states" to="/joint_states" />
10      <remap from="~commands" to="/whole_body_controller/velocity_controller/
11        command" />
12    </node>
13
14    <node pkg="robot_state_publisher" type="robot_state_publisher"
15      name="robot_state_publisher" />
16
17    <node pkg="tf2_ros" type="buffer_server" name="tf2_buffer_server" />
18
19    <include file="$(find iai_pr2_sim)/launch/fake_localization.launch" />
20  </group>
21
22  <include file="$(find giskard_pr2)/launch/qp_controller.launch" >
23    <arg name="sim" value="true" />
24    <arg name="trajectory_controller" value="false" />
25  </include>
26
27  <group>
28    <node pkg="rviz" type="rviz" name="rviz" required="true"
29      args="-d $(find skill_transfer)/config/simulator.rviz" />
30  </group>
31 </launch>
```

66 launch/simulation.launch

```
1 <launch>
2   <!-- We resume the logic in empty_world.launch, changing only the name of the
      world to be launched -->
3   <include file="$(find gazebo_ros)/launch/empty_world.launch">
4     <arg name="world_name" value="$(find skill_transfer)/worlds/$(arg world).
      world"/>
5     <arg name="paused" value="false"/>
6     <arg name="use_sim_time" value="true"/>
7     <arg name="gui" value="true"/>
8     <arg name="headless" value="false"/>
9     <arg name="debug" value="false"/>
10    <arg name="verbose" value="true"/>
11    <arg name="physics" default="ode"/>
12  </include>
13 </launch>
```

67 launch/visualization.launch

```
1 <launch>
2   <env name="GAZEBO_MODEL_PATH" value="$(find skill_transfer)/models"/>
3
4   <include file="$(find gazebo2rviz)/launch/gazebo2rviz.launch"/>
5   <node name="rviz" pkg="rviz" type="rviz"/>
6 </launch>
```

68 `include/skillttransfer/giskardadapter.h`

```

1  #ifndef GISKARD_ADAPTER_H
2  #define GISKARD_ADAPTER_H
3
4  #include <giskard_core/giskard_core.hpp>
5  #include <geometry_msgs/Twist.h>
6  #include <sensor_msgs/JointState.h>
7  #include <visualization_msgs/Marker.h>
8  #include <string>
9  #include <vector>
10
11 class GiskardAdapter
12 {
13 public:
14     GiskardAdapter(int nWSR);
15
16     void createController(const std::string &constraints);
17     void startController(const Eigen::VectorXd &inputs);
18     void updateController(const Eigen::VectorXd &inputs);
19     geometry_msgs::Twist getDesiredFrameTwistMsg(
20         const Eigen::VectorXd &inputs,
21         const std::string &frame_name);
22     geometry_msgs::Twist getMeasuredFrameTwistMsg(
23         const Eigen::VectorXd &inputs,
24         const Eigen::VectorXd &velocities,
25         const std::string &frame_name);
26     sensor_msgs::JointState getDesiredJointVelocityMsg();
27     double getDistance();
28     std::vector<visualization_msgs::Marker> getVisualizationMsgs();
29
30     bool controller_started_;
31     int nWSR_;
32
33 private:
34     giskard_core::QPController controller_;
35 };
36
37 #endif // GISKARD_ADAPTER_H

```

69 `include/skillttransfer/twisttlog.h`

```
1  #ifndef TWIST_LOG_H
2  #define TWIST_LOG_H
3
4  #include <deque>
5  #include <geometry_msgs/Twist.h>
6
7  class TwistLog
8  {
9  public:
10     TwistLog(unsigned int size);
11     void push(geometry_msgs::Twist twist);
12     void clear();
13     bool allFilledAndBelowThreshold(double threshold);
14
15 protected:
16     std::deque<geometry_msgs::Twist> log_;
17     std::deque<geometry_msgs::Twist>::size_type size_;
18 };
19
20 #endif
```

70 include/skill_transfer/watchdog.hpp

```
1  /*
2  * Copyright (C) 2016-2017 Georg Bartels <georg.bartels@cs.uni-bremen.de>
3  *
4  * This file is part of giskard.
5  *
6  * giskard is free software; you can redistribute it and/or
7  * modify it under the terms of the GNU General Public License
8  * as published by the Free Software Foundation; either version 2
9  * of the License, or (at your option) any later version.
10 *
11 * This program is distributed in the hope that it will be useful,
12 * but WITHOUT ANY WARRANTY; without even the implied warranty of
13 * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
14 * GNU General Public License for more details.
15 *
16 * You should have received a copy of the GNU General Public License
17 * along with this program; if not, write to the Free Software
18 * Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301, USA
19 */
20
21 #ifndef __GISKARD_WATCHDOG_HPP__
22 #define __GISKARD_WATCHDOG_HPP__
23
24 namespace giskard_ros
25 {
26     template<class Time, class Duration>
27     class Watchdog
28     {
29     public:
30         bool barking(const Time& now)
31         {
32             return (now - last_kick_) > period_;
33         }
34
35         void setPeriod(const Duration& period)
36         {
37             period_ = period;
38         }
39
40         const Duration& getPeriod() const
41         {
42             return period_;
43         }
44
45         void kick(const Time& now)
46         {
47             last_kick_ = now;
48         }
49
50         const Time& getLastPetTime() const
51         {
52             return last_kick_;
53         }
54     private:
```



```
55         Duration period_;
56         Time last_kick_;
57     };
58 }
59
60 #endif // __GISKARD_WATCHDOG__HPP
```

71 include/skill_ttransfer/conversions.h

```

1  #ifndef CONVERSIONS_H
2  #define CONVERSIONS_H
3
4  #include <map>
5  #include <vector>
6  #include <giskard_core/giskard_core.hpp>
7  #include <kdl_conversions/kdl_msg.h>
8  #include <sensor_msgs/JointState.h>
9
10 template <class T, class U>
11 inline std::map<T, U> toMap(const std::vector<T> &keys, const std::vector<U> &
    values)
12 {
13     // FIXME: move move to another package
14     if (keys.size() != values.size())
15         throw std::runtime_error("Number of keys not equal to numbers of values.");
16
17     std::map<T, U> result;
18     for (size_t i = 0; i < keys.size(); ++i)
19         result.insert(std::pair<T, U>(keys[i], values[i]));
20
21     return result;
22 }
23
24 inline Eigen::VectorXd msgPoseToEigenVector(const geometry_msgs::Pose &pose)
25 {
26     // FIXME: refactor this into a header file
27     KDL::Frame frame;
28     tf::poseMsgToKDL(pose, frame);
29
30     Eigen::VectorXd result(6);
31
32     result(0) = pose.position.x;
33     result(1) = pose.position.y;
34     result(2) = pose.position.z;
35
36     KDL::Rotation::Quaternion(
37         pose.orientation.x, pose.orientation.y, pose.orientation.z, pose.
            orientation.w)
38         .GetEulerZYX(result(3), result(4),
39                     result(5));
40
41     return result;
42 }
43
44 inline Eigen::VectorXd kdlFrameToEigenVector(const KDL::Frame &frame)
45 {
46     Eigen::VectorXd result(6);
47
48     result(0) = frame.p.x();
49     result(1) = frame.p.y();
50     result(2) = frame.p.z();
51     frame.M.GetEulerZYX(result(3), result(4), result(5));
52
53     return result;

```

```

54 }
55
56 inline std::vector<double> eigenVectorToStdVector(const Eigen::VectorXd &v)
57 {
58     // FIXME: where to put this?
59     std::vector<double> result;
60     for (int i = 0; i < v.rows(); ++i)
61         result.push_back(v(i));
62
63     return result;
64 }
65
66 inline geometry_msgs::Twist eigenVectorToMsgTwist(const Eigen::VectorXd &t)
67 {
68     if (t.rows() != 6)
69         throw std::runtime_error("Did not receive vector representing a twist with 6
        values.");
70
71     geometry_msgs::Twist result;
72
73     result.linear.x = t(0);
74     result.linear.y = t(1);
75     result.linear.z = t(2);
76     result.angular.x = t(3);
77     result.angular.y = t(4);
78     result.angular.z = t(5);
79
80     return result;
81 }
82
83 inline sensor_msgs::JointState eigenVectorToMsgJointState(const Eigen::VectorXd
    &t)
84 {
85     if (t.rows() != 15)
86         throw std::runtime_error("Did not receive vector representing a twist with 6
        values.");
87
88     sensor_msgs::JointState result;
89
90     result.name = std::vector<std::string>{
91         "torso_lift_joint",
92         "l_shoulder_pan_joint",
93         "l_shoulder_lift_joint",
94         "l_upper_arm_roll_joint",
95         "l_elbow_flex_joint",
96         "l_forearm_roll_joint",
97         "l_wrist_flex_joint",
98         "l_wrist_roll_joint",
99         "r_shoulder_pan_joint",
100        "r_shoulder_lift_joint",
101        "r_upper_arm_roll_joint",
102        "r_elbow_flex_joint",
103        "r_forearm_roll_joint",
104        "r_wrist_flex_joint",
105        "r_wrist_roll_joint"
106    };
107

```

```
108     result.velocity = std::vector<double>{
109         t(0),
110         t(1),
111         t(2),
112         t(3),
113         t(4),
114         t(5),
115         t(6),
116         t(7),
117         t(8),
118         t(9),
119         t(10),
120         t(11),
121         t(12),
122         t(13),
123         t(14)
124     };
125
126     return result;
127 }
128
129 #endif
```

72 `include/skillttransfer/giskarduutils.h`

```
1  #ifndef GISKARD_UTILS
2  #define GISKARD_UTILS
3
4  #include <giskard_core/giskard_core.hpp>
5  #include "skill_transfer/conversions.h"
6
7  inline giskard_core::QPController generateController(const std::string &
8              yaml_string)
9  {
10     // FIXME: add this to giskard_core
11     YAML::Node node = YAML::Load(yaml_string);
12     giskard_core::QPControllerSpec spec = node.as<giskard_core::QPControllerSpec>();
13     giskard_core::QPController controller = giskard_core::generate(spec);
14     return controller;
15 }
16
17 inline KDL::Jacobian getJacobian(const giskard_core::QPController &controller,
18                                 const std::string &frame_name, const Eigen::
19                                 VectorXd &observables)
20 {
21     const KDL::Expression<KDL::Frame>::Ptr controlled_frame =
22         controller.get_scope().find_frame_expression(frame_name);
23     controlled_frame->setInputValues(eigenVectorToStdVector(observables));
24     controlled_frame->value();
25
26     const auto size = observables.size();
27
28     KDL::Jacobian jac(size);
29     for (size_t i = 0; i < size; ++i)
30         jac.setColumn(i, controlled_frame->derivative(i));
31
32     return jac;
33 }
34
35 #endif
```

73 include/skill_transfer/giskard_viz.h

```
1 #include <visualization_msgs/Marker.h>
2 #include <giskard_core/giskard_core.hpp>
3
4 inline visualization_msgs::Marker createPointMarker(const giskard_core::
      QPController &controller,
5
6                                     const std::string &exp_name,
6                                     const std::string &
7                                     frame_id)
8 {
9     const KDL::Expression<KDL::Vector>::Ptr exp =
10     controller.get_scope().find_vector_expression(exp_name);
11
12     visualization_msgs::Marker marker;
13
14     marker.header.frame_id = frame_id;
15     marker.header.stamp = ros::Time::now();
16     marker.ns = "giskard_expressions/" + exp_name;
17     marker.id = 1;
18     marker.type = visualization_msgs::Marker::SPHERE;
19     marker.action = visualization_msgs::Marker::ADD;
20     marker.pose.position.x = exp->value().x();
21     marker.pose.position.y = exp->value().y();
22     marker.pose.position.z = exp->value().z();
23     marker.pose.orientation.w = 1.0;
24     marker.scale.x = 0.01;
25     marker.scale.y = 0.01;
26     marker.scale.z = 0.01;
27     marker.color.r = 244.0f / 255.0f;
28     marker.color.g = 180.0f / 255.0f;
29     marker.color.b = 47.0f / 255.0f;
30     marker.color.a = 1.0;
31
32     return marker;
33 }
34
35 inline visualization_msgs::Marker createPointDirectionMarker(const giskard_core
      ::QPController &controller,
36
37                                     const std::string &
38                                     point_name,
39                                     const std::string &
40                                     direction_name,
41                                     const std::string &
42                                     frame_id)
43 {
44     const KDL::Expression<KDL::Vector>::Ptr point_exp =
45     controller.get_scope().find_vector_expression(point_name);
46     const KDL::Expression<KDL::Vector>::Ptr direction_exp =
47     controller.get_scope().find_vector_expression(direction_name);
48
49     visualization_msgs::Marker marker;
50
51     marker.header.frame_id = frame_id;
52     marker.header.stamp = ros::Time::now();
53     marker.ns = "giskard_expressions/" + direction_name;
54     marker.id = 1;
```

```

49     marker.type = visualization_msgs::Marker::ARROW;
50     marker.action = visualization_msgs::Marker::ADD;
51     marker.points.resize(2);
52     marker.points[0].x = point_exp->value().x();
53     marker.points[0].y = point_exp->value().y();
54     marker.points[0].z = point_exp->value().z();
55     marker.points[1].x = point_exp->value().x() + direction_exp->value().x();
56     marker.points[1].y = point_exp->value().y() + direction_exp->value().y();
57     marker.points[1].z = point_exp->value().z() + direction_exp->value().z();
58     marker.scale.x = 0.01;
59     marker.scale.y = 0.02;
60     marker.scale.z = 0.0;
61     marker.color.r = 244.0f / 255.0f;
62     marker.color.g = 180.0f / 255.0f;
63     marker.color.b = 47.0f / 255.0f;
64     marker.color.a = 1.0;
65
66     return marker;
67 }

```

74 plugins/tf_broadcaster_plugin.cpp

```

1  #include <gazebo/common/Plugin.hh>
2  #include <gazebo/physics/physics.hh>
3  #include <ros/ros.h>
4  #include <ros/callback_queue.h>
5  #include <ros/subscribe_options.h>
6  #include <geometry_msgs/Twist.h>
7  #include <string>
8  #include <thread>
9  #include <tf2_ros/transform_listener.h>
10 #include <geometry_msgs/TransformStamped.h>
11 #include <tf2_ros/transform_broadcaster.h>
12
13 namespace gazebo
14 {
15   class TfBroadcasterPlugin : public ModelPlugin
16   {
17   public:
18     TfBroadcasterPlugin() : ModelPlugin()
19     {
20     }
21
22     ~TfBroadcasterPlugin()
23     {
24     }
25
26     void Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf)
27     {
28       // Make sure the ROS node for Gazebo has already been initialized
29       if (!ros::isInitialized())
30       {
31         ROS_FATAL_STREAM("A ROS node for Gazebo has not been initialized, unable
32           to load plugin."
33           << "Load the Gazebo system plugin 'libgazebo_ros_api_plugin.so' in the
34             gazebo_ros package)");
35         return;
36       }
37
38       // SDF values
39       link_name_ = _sdf->GetElement("linkName")->Get<std::string>();
40       frame_name_ = _sdf->GetElement("frameName")->Get<std::string>();
41
42       // Link
43       link_ = _parent->GetLink(this->link_name_);
44
45       // Custom Callback Queue
46       queue_thread_ = std::thread( boost::bind( &TfBroadcasterPlugin::QueueThread,
47         this ) );
48
49       // Listen to the update event. This event is broadcast every
50       // simulation iteration.
51       update_connection_ = event::Events::ConnectWorldUpdateBegin(
52         boost::bind(&TfBroadcasterPlugin::UpdateChild, this, _1));
53     }
54   }
55 }

```



```

53 void UpdateChild(const common::UpdateInfo &_info)
54 {
55     const auto current_sim_time = _info.simTime;
56     const auto delta_sim_time = current_sim_time - this->previous_sim_time_;
57
58     PublishTf(delta_sim_time);
59 }
60
61 void PublishTf(const common::Time _delta_time)
62 {
63     math::Pose pose = link_->GetWorldPose();
64
65     geometry_msgs::TransformStamped transformStamped;
66
67     transformStamped.header.stamp = ros::Time::now();
68     transformStamped.header.frame_id = "world";
69     transformStamped.child_frame_id = frame_name_;
70     transformStamped.transform.translation.x = pose.pos.x;
71     transformStamped.transform.translation.y = pose.pos.y;
72     transformStamped.transform.translation.z = pose.pos.z;
73
74     transformStamped.transform.rotation.x = pose.rot.x;
75     transformStamped.transform.rotation.y = pose.rot.y;
76     transformStamped.transform.rotation.z = pose.rot.z;
77     transformStamped.transform.rotation.w = pose.rot.w;
78
79     br_.sendTransform(transformStamped);
80 }
81
82 private:
83     std::string link_name_;
84     std::string frame_name_;
85     ros::NodeHandle nh_;
86     ros::CallbackQueue queue_;
87     std::thread queue_thread_;
88     physics::LinkPtr link_;
89     event::ConnectionPtr update_connection_;
90     common::Time previous_sim_time_;
91     tf2_ros::TransformBroadcaster br_;
92
93     void QueueThread()
94     {
95         static const double timeout = 0.01;
96
97         while (this->nh_.ok())
98         {
99             this->queue_.callAvailable(ros::WallDuration(timeout));
100         }
101     }
102 };
103
104 GZ_REGISTER_MODEL_PLUGIN(TfBroadcasterPlugin)
105 }

```

75 plugins/giskard_visualization_plugin.cpp

```

1  #include <gazebo/common/Plugin.hh>
2  #include <gazebo/physics/physics.hh>
3  #include <ros/ros.h>
4  #include <ros/callback_queue.h>
5  #include <ros/subscribe_options.h>
6  #include <visualization_msgs/Marker.h>
7  #include <boost/format.hpp>
8  #include <map>
9  #include <set>
10 #include <string>
11 #include <mutex>
12 #include <thread>
13
14 namespace gazebo
15 {
16 class GiskardVisualizationPlugin : public WorldPlugin
17 {
18 private:
19     /// \brief A node use for ROS transport
20     std::unique_ptr<ros::NodeHandle> node_handle_;
21     /// \brief A ROS subscriber
22     ros::Subscriber subscriber_;
23     /// \brief A ROS callbackqueue that helps process messages
24     ros::CallbackQueue queue_;
25     std::thread queue_thread_;
26     std::mutex mutex_;
27     physics::WorldPtr world_;
28     event::ConnectionPtr update_connection_;
29     std::map<std::string, visualization_msgs::Marker> markers_;
30     // To avoid duplicated markers, Gazebo sometimes doesn't
31     // realise that a model has already been created?
32     std::set<std::string> created_markers_;
33
34 public:
35     GiskardVisualizationPlugin() : WorldPlugin()
36     {
37     }
38
39     void Load(physics::WorldPtr _world, sdf::ElementPtr _sdf)
40     {
41         // Make sure the ROS node for Gazebo has already been initialized
42         if (!ros::isInitialized())
43         {
44             ROS_FATAL_STREAM("A ROS node for Gazebo has not been initialized, unable to load plugin."
45                 << "Load the Gazebo system plugin'
46                 libgazebo_ros_api_plugin.so' in the gazebo_ros package
47                 ");
48             return;
49         }
50
51         this->world_ = _world;
52
53         // Create our ROS node. This acts in a similar manner to
54         // the Gazebo node

```

```

53     this->node_handle_.reset(new ros::NodeHandle("gazebo_client"));
54
55     // Create a named topic, and subscribe to it.
56     ros::SubscribeOptions so =
57         ros::SubscribeOptions::create<visualization_msgs::Marker>(
58             "/giskard/visualization_marker",
59             10,
60             boost::bind(&GiskardVisualizationPlugin::OnRosMsg, this, _1),
61             ros::VoidPtr(), &this->queue_);
62     this->subscriber_ = this->node_handle_->subscribe(so);
63
64     // Custom Callback Queue
65     this->queue_thread_ = std::thread(boost::bind(&GiskardVisualizationPlugin::
        QueueThread, this));
66
67     this->update_connection_ = event::Events::ConnectWorldUpdateBegin(
68         boost::bind(&GiskardVisualizationPlugin::Update, this));
69 }
70
71 void Update()
72 {
73     std::lock_guard<std::mutex> lock{this->mutex_};
74
75     for (const auto p : this->markers_)
76     {
77         const visualization_msgs::Marker &msg = p.second;
78         const std::string &name = msg.ns;
79
80         if (created_markers_.find(name) != created_markers_.end())
81         {
82             auto model = this->world_->GetModel(name);
83
84             if (model)
85             {
86                 updateMarkerModel(model, msg);
87             }
88         }
89         else
90         {
91             createMarkerModel(msg);
92         }
93     }
94 }
95
96 void createMarkerModel(const visualization_msgs::Marker &_msg)
97 {
98     const std::string &name = _msg.ns;
99
100     std::string pose = boost::str(boost::format("%1%_2%_3%0_0_0") %
101                                     (_msg.pose.position.x) %
102                                     (_msg.pose.position.y) %
103                                     (_msg.pose.position.z));
104     sdf::SDF sphereSDF;
105     sphereSDF.SetFromString(
106         "<sdf version='1.6'>\
107         <model name='sphere'>\
108         <static>true</static>\

```

```

109     <pose>" +
110         pose + "</pose>\
111     <link name='link'>\
112     <pose>0 0 0 0 0 0</pose>\
113     <visual name='visual'>\
114     <geometry>\
115     <sphere><radius>0.005</radius></sphere>\
116     </geometry>\
117     <material>\
118     <script>\
119     <name>Gazebo/Yellow</name>\
120     <uri>file://media/materials/scripts/gazebo.material</uri>
121     >\
122     </script>\
123     </material>\
124     </visual>\
125     </link>\
126     </model>\
127     </sdf>";
128
129     sdf::ElementPtr modelSDF = sphereSDF.Root()->GetElement("model");
130     modelSDF->GetAttribute("name")->SetFromString(name);
131     this->world_->InsertModelSDF(sphereSDF);
132     created_markers_.insert(name);
133
134     gzdbg << "Created Marker: " << name << "\n";
135 }
136
137 void updateMarkerModel(physics::ModelPtr model, const visualization_msgs::
138     Marker &_msg)
139 {
140     math::Pose pose(_msg.pose.position.x,
141                     _msg.pose.position.y,
142                     _msg.pose.position.z,
143                     0.0, 0.0, 0.0);
144     model->SetWorldPose(pose);
145 }
146
147 /// \brief Handle an incoming message from ROS
148 void OnRosMsg(const visualization_msgs::MarkerConstPtr &_msg)
149 {
150     if (_msg->type != visualization_msgs::Marker::SPHERE)
151     {
152         return;
153     }
154
155     std::lock_guard<std::mutex> lock{this->mutex_};
156
157     this->markers_[_msg->ns] = *_msg;
158 }
159
160 private:
161 void QueueThread()
162 {
163     static const double timeout = 0.01;
164
165     while (this->node_handle_->ok())

```

```
164     {
165         this->queue_.callAvailable(ros::WallDuration(timeout));
166     }
167 }
168 };
169
170 GZ_REGISTER_WORLD_PLUGIN(GiskardVisualizationPlugin)
171 }
```

76 plugins/GripPlugin.cc

```
1  #include "GripPlugin.hh"
2
3  #include <gazebo/physics/physics.hh>
4  #include <string>
5
6  using namespace gazebo;
7
8  // Register this plugin with the simulator
9  GZ_REGISTER_MODEL_PLUGIN(GripPlugin);
10
11 void GripPlugin::Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf) {
12     const auto parentModel = _parent;
13     const auto world = parentModel->GetWorld();
14     const auto physics = world->GetPhysicsEngine();
15
16     const std::string childLinkName = _sdf->GetElement("childLinkName")->Get<std::string>();
17     const std::string parentLinkName = _sdf->GetElement("parentLinkName")->Get<std::string>();
18
19     const auto parentLink = parentModel->GetLink(parentLinkName);
20     const auto childLink = boost::dynamic_pointer_cast<physics::Link>(world->GetEntity(childLinkName));
21
22     math::Pose relativePose;
23
24     if (_sdf->HasElement("relativePose")) {
25         relativePose = _sdf->GetElement("relativePose")->Get<math::Pose>();
26
27         const auto parentPose = parentLink->GetWorldPose();
28         const auto childPose = math::Pose(parentPose.pos + (parentPose.rot.RotateVector(relativePose.pos)), parentPose.rot * relativePose.rot);
29
30         childLink->SetWorldPose(childPose);
31
32         gzdbg << "Grip: Relative pose given, adjusting child pose\n"
33             << childPose << "\n";
34     } else {
35         relativePose = parentLink->GetWorldPose() - childLink->GetWorldPose();
36
37         gzdbg << "Grip: Relative pose derived\n";
38     }
39
40     // Create joint
41     const auto joint = physics->CreateJoint("fixed", parentModel);
42     // Bullet physics needs accurate joint position
43     // ODE doesn't care
44     joint->Load(parentLink, childLink, relativePose);
45     joint->Init();
46     joint->SetName("grip_joint_" + parentLink->GetScopedName() + "_" + childLink->GetScopedName());
47
48     childLink->SetGravityMode(false);
49 }
```

77 plugins/GrainsFactoryPlugin.hh

```
1  #ifndef PLUGINS_GRAINSFACTORYPLUGIN_H
2  #define PLUGINS_GRAINSFACTORYPLUGIN_H
3
4
5  #include <gazebo/gazebo.hh>
6
7  namespace gazebo {
8      class GrainsFactoryPlugin : public WorldPlugin {
9          public: void Load(physics::WorldPtr _parent, sdf::ElementPtr _sdf)
10                 override;
11     };
12
13
14 #endif //PLUGINS_GRAINSFACTORYPLUGIN_H
```

78 plugins/GrainsFactoryPlugin.cc

```
1  #include "GrainsFactoryPlugin.hh"
2  #include <gazebo/physics/physics.hh>
3  #include <sstream>
4
5  using namespace gazebo;
6
7  GZ_REGISTER_WORLD_PLUGIN(GrainsFactoryPlugin)
8
9  void GrainsFactoryPlugin::Load(physics::WorldPtr _parent, sdf::ElementPtr _sdf)
10 {
11     std::string poseArg = _sdf->GetElement("pose")->GetValue()->GetAsString();
12     std::istringstream pss(poseArg);
13
14     double x, y, z, pitch, yaw, roll;
15     pss >> x >> y >> z >> roll >> pitch >> yaw;
16
17     math::Pose pose(x, y, z, roll, pitch, yaw);
18
19     int quantity = 3;
20     double radius = 0.01;
21     double mass = 0.001;
22     double inertiaDiagonal = 0.4 * mass * radius * radius;
23     double friction = 0.4;
24     double friction2 = 0.4;
25     double velocityDecay = 0.6;
26
27     _sdf->GetElement("mass")->GetValue()->Get(mass);
28     _sdf->GetElement("radius")->GetValue()->Get(radius);
29     _sdf->GetElement("quantity")->GetValue()->Get(quantity);
30     _sdf->GetElement("friction")->GetValue()->Get(friction);
31     _sdf->GetElement("friction2")->GetValue()->Get(friction2);
32     _sdf->GetElement("velocity_decay")->GetValue()->Get(velocityDecay);
33
34     for (int i = 0; i < quantity; ++i) {
35         std::stringstream xml;
36         xml << "<sdf version='1.6'>\n";
37         xml << "<model name='grain_" << i << "'>\n";
38         xml << "<t<pose>" << pose << "</pose>\n";
39         xml << "<t<link name='link'" << i << "'>\n";
40         xml << "<t<pose>0 0 0 0 0 0</pose>\n";
41         xml << "<t<inertial>\n";
42         xml << "<t<pose>0 0 0 0 0 0</pose>\n";
43         xml << "<t<mass>" << mass << "</mass>\n";
44         xml << "<t<inertia>\n";
45         xml << "<t<ixx>" << inertiaDiagonal << "</ixx>";
46         xml << "<t<ixy>0</ixy>";
47         xml << "<t<ixz>0</ixz>";
48         xml << "<t<iyy>" << inertiaDiagonal << "</iyy>";
49         xml << "<t<iyz>0</iyz>";
50         xml << "<t<izz>" << inertiaDiagonal << "</izz>";
51         xml << "</inertial>\n";
52         xml << "<velocity_decay>\n";
53         xml << "<angular>" << velocityDecay << "</angular>\n";
54         xml << "</velocity_decay>\n";
```


79 plugins/StickPlugin.cc

```
1  #include "StickPlugin.hh"
2
3  #include <gazebo/physics/physics.hh>
4  #include <string>
5
6  using namespace gazebo;
7
8  // Register this plugin with the simulator
9  GZ_REGISTER_MODEL_PLUGIN(StickPlugin);
10
11 StickPlugin::StickPlugin(): ModelPlugin(), joint(nullptr) {
12 }
13
14 void StickPlugin::Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf) {
15     this->model = _parent;
16     const auto world = this->model->GetWorld();
17     this->physics = world->GetPhysicsEngine();
18
19     const std::string childLinkName = _sdf->GetElement("childLinkName")->Get<std::string>();
20     const std::string parentLinkName = _sdf->GetElement("parentLinkName")->Get<std::string>();
21     this->forceThreshold = _sdf->GetElement("force")->Get<double>();
22
23     this->parentLink = this->model->GetLink(parentLinkName);
24     this->childLink = boost::dynamic_pointer_cast<physics::Link>(world->GetEntity(childLinkName));
25
26     this->CreateJoint();
27 }
28
29 void StickPlugin::OnUpdate(const common::UpdateInfo &_info) {
30     if (_info.simTime < 1.0) {
31         // Let the stage settle down and position objects
32         return;
33     }
34
35     auto wrench = this->joint->GetForceTorque(0u);
36     auto measuredForce = wrench.body1Force;
37
38     auto force = this->forceThreshold;
39
40     auto measuredForceLength = measuredForce.GetLength();
41
42     if (measuredForceLength > force) {
43         gzdbg << "Removed joint: " << "(" << joint->GetName() << "), force: "
44             << measuredForceLength << "\n";
45
46         this->BreakJoint();
47     }
48 }
49
50 void StickPlugin::Reset() {
51     if (this->joint == nullptr) {
```

```

52         this->CreateJoint();
53     }
54 }
55
56 void StickPlugin::CreateJoint() {
57     this->joint = this->physics->CreateJoint("fixed", this->model);
58     // Bullet physics needs accurate joint position
59     // ODE doesn't care
60     this->joint->Load(this->parentLink, this->childLink, this->parentLink->
        GetWorldPose() - this->childLink->GetWorldPose());
61     this->joint->Init();
62     this->joint->SetProvideFeedback(true);
63     this->joint->SetName("stick_joint_" + this->parentLink->GetScopedName() + "_"
        + this->childLink->GetScopedName());
64
65     // Disable gravity on the butter link
66     this->parentLink->SetGravityMode(false);
67
68     this->updateConnection = event::Events::ConnectWorldUpdateBegin(
69         boost::bind(&StickPlugin::OnUpdate, this, _1));
70 }
71
72 void StickPlugin::BreakJoint() {
73     this->joint->Detach();
74     this->joint = nullptr;
75
76     // Enable gravity on the childLink
77     this->parentLink->SetGravityMode(true);
78
79     event::Events::DisconnectWorldUpdateBegin(this->updateConnection);
80     this->updateConnection = nullptr;
81 }

```

80 plugins/OtherGraspPlugin.cc

```
1  #include "OtherGraspPlugin.hh"
2
3  #include <ros/ros.h>
4  #include <gazebo/physics/physics.hh>
5  #include <string>
6  #include <gazebo/sensors/sensors.hh>
7
8  using namespace gazebo;
9  GZ_REGISTER_SENSOR_PLUGIN(OtherGraspPlugin)
10
11  //////////////////////////////////////
12  OtherGraspPlugin::OtherGraspPlugin() : SensorPlugin()
13  {
14  }
15
16  //////////////////////////////////////
17  OtherGraspPlugin::~OtherGraspPlugin()
18  {
19  }
20
21  //////////////////////////////////////
22  void OtherGraspPlugin::Load(sensors::SensorPtr _sensor, sdf::ElementPtr _sdf)
23  {
24      //std::cout << "initialised graspingplugin \n";
25      ROS_INFO("Hello World!");
26      // Get the parent sensor.
27      this->parentSensor =
28          std::dynamic_pointer_cast<sensors::ContactSensor>(_sensor);
29
30      const std::string childLinkName1 = _sdf->GetElement("childLinkName1")->Get<std::string>();
31      const std::string childLinkName2 = _sdf->GetElement("childLinkName2")->Get<std::string>();
32      const std::string childLinkName3 = _sdf->GetElement("childLinkName3")->Get<std::string>();
33      const std::string parentLinkName = _sdf->GetElement("parentLinkName")->Get<std::string>();
34      const std::string SensorName = _sdf->GetElement("sensorName")->Get<std::string>();
35
36      // Make sure the parent sensor is valid.
37      if (!this->parentSensor)
38      {
39          gzerr << "ContactPlugin requires a ContactSensor.\n";
40          return;
41      }
42
43      // Connect to the sensor update event.
44      this->updateConnection = this->parentSensor->ConnectUpdated(
45          std::bind(&OtherGraspPlugin::OnUpdate, this));
46
47      // Make sure the parent sensor is active.
48      this->parentSensor->SetActive(true);
49
50      std::cout << "initialised graspingplugin\n";
```

```

51     gzdbg << "message" << std::endl;
52 }
53
54 //////////////////////////////////////
55 void OtherGraspPlugin::OnUpdate()
56 {
57     // Get all the contacts.
58     msgs::Contacts contacts;
59     contacts = this->parentSensor->Contacts();
60     for (unsigned int i = 0; i < contacts.contact_size(); ++i)
61     {
62         std::cout << "Collision between[" << contacts.contact(i).collision1()
63             << "]" and[" << contacts.contact(i).collision2() << "]\n";
64
65         for (unsigned int j = 0; j < contacts.contact(i).position_size(); ++j)
66         {
67             std::cout << j << " Position:"
68                 << contacts.contact(i).position(j).x() << " "
69                 << contacts.contact(i).position(j).y() << " "
70                 << contacts.contact(i).position(j).z() << "\n";
71             std::cout << " Normal:"
72                 << contacts.contact(i).normal(j).x() << " "
73                 << contacts.contact(i).normal(j).y() << " "
74                 << contacts.contact(i).normal(j).z() << "\n";
75             std::cout << " Depth:" << contacts.contact(i).depth(j) << "\n";
76         }
77     }
78 }

```

81 plugins/GripPlugin.hh

```
1  #ifndef PLUGINS_GRIPPLUGIN_HH
2  #define PLUGINS_GRIPPLUGIN_HH
3
4  #include <gazebo/gazebo.hh>
5
6  namespace gazebo {
7      class GripPlugin : public ModelPlugin {
8      public: void Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf) override;
9      };
10 }
11
12 #endif //PLUGINS_GRIPPLUGIN_HH
```

82 plugins/position_controller_plugin.cpp

```

1  #include <gazebo/common/Plugin.hh>
2  #include <gazebo/physics/physics.hh>
3  #include <ros/ros.h>
4  #include <ros/callback_queue.h>
5  #include <ros/subscribe_options.h>
6  #include <geometry_msgs/Twist.h>
7  #include <string>
8  #include <thread>
9  #include <tf2_ros/transform_listener.h>
10 #include <geometry_msgs/TransformStamped.h>
11
12 namespace gazebo
13 {
14   class ForceControllerPlugin : public ModelPlugin
15   {
16   public:
17     ForceControllerPlugin() : ModelPlugin(), P_(0.0), I_(0.0), D_(0.0), tfListener
        (tfBuffer)
18     {
19     }
20
21     ~ForceControllerPlugin()
22     {
23     }
24
25     void Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf)
26     {
27       // Make sure the ROS node for Gazebo has already been initialized
28       if (!ros::isInitialized())
29       {
30         ROS_FATAL_STREAM("A ROS node for Gazebo has not been initialized, unable
            to load plugin.")
31         << "Load the Gazebo system plugin 'libgazebo_ros_api_plugin.so' in the
            gazebo_ros package)";
32         return;
33       }
34
35       // SDF values
36       this->link_name_ = _sdf->GetElement("linkName")->Get<std::string>();
37       this->target_frame_name_ = _sdf->GetElement("targetFrameName")->Get<std::
            string>();
38       this->reference_frame_name_ = _sdf->GetElement("referenceFrameName")->Get<
            std::string>();
39       this->P_ = 10000.0;
40       this->I_ = 0.0;
41       this->D_ = 7000.0;
42
43       // Link
44       this->link_ = _parent->GetLink(this->link_name_);
45
46       // Custom Callback Queue
47       this->queue_thread_ = std::thread( boost::bind( &ForceControllerPlugin::
            QueueThread, this ) );
48
49

```

```

50 // Listen to the update event. This event is broadcast every
51 // simulation iteration.
52 this->update_connection_ = event::Events::ConnectWorldUpdateBegin(
53     boost::bind(&ForceControllerPlugin::UpdateChild, this, _1));
54
55 double l_P = 1.0;
56 double l_I = 0.0;
57 double l_D = 1.0;
58
59 this->pid_linear_x_ = common::PID(P_, I_, D_);
60 this->pid_linear_y_ = common::PID(P_, I_, D_);
61 this->pid_linear_z_ = common::PID(P_, I_, D_);
62 this->pid_angular_x_ = common::PID(l_P, l_I, l_D);
63 this->pid_angular_y_ = common::PID(l_P, l_I, l_D);
64 this->pid_angular_z_ = common::PID(l_P, l_I, l_D);
65 }
66
67 void UpdateChild(const common::UpdateInfo &_info)
68 {
69     const auto current_sim_time = _info.simTime;
70     const auto delta_sim_time = current_sim_time - this->previous_sim_time_;
71
72     UpdateObjectForces(delta_sim_time);
73 }
74
75 void UpdateObjectForces(const common::Time _delta_time)
76 {
77     geometry_msgs::TransformStamped transformStamped;
78
79     try
80     {
81         transformStamped = tfBuffer.lookupTransform(
82             this->reference_frame_name_, this->target_frame_name_, ros::Time(0));
83     }
84     catch (tf2::TransformException &ex)
85     {
86         ROS_WARN("%s", ex.what());
87         return;
88     }
89
90     math::Pose current_pose = this->link_->GetWorldPose();
91     math::Pose desired_pose = math::Pose(
92         math::Vector3(transformStamped.transform.translation.x,
93                       transformStamped.transform.translation.y,
94                       transformStamped.transform.translation.z),
95         math::Quaternion(transformStamped.transform.rotation.w,
96                          transformStamped.transform.rotation.x,
97                          transformStamped.transform.rotation.y,
98                          transformStamped.transform.rotation.z)
99     );
100     math::Vector3 force;
101     math::Vector3 torque;
102
103     force.x = this->pid_linear_x_.Update(current_pose.pos.x - desired_pose.pos.x
104                                         , _delta_time);
104     force.y = this->pid_linear_y_.Update(current_pose.pos.y - desired_pose.pos.y
105                                         , _delta_time);

```



```

105     force.z = this->pid_linear_z_.Update(current_pose.pos.z - desired_pose.pos.z
106         , _delta_time);
107
108     // gzdbg << "Current pos: " << current_pose.pos.x << " " << current_pose.pos
109     .y << " " << current_pose.pos.z << "\n";
110     // gzdbg << "Desired pos: " << desired_pose.pos.x << " " << desired_pose.pos
111     .y << " " << desired_pose.pos.z << "\n";
112     // gzdbg << "Error: " << current_pose.pos.x - desired_pose.pos.x << " "
113     << current_pose.pos.y - desired_pose.pos.y << " " << current_pose.pos.z -
114     desired_pose.pos.z << "\n";
115     // gzdbg << "Force: " << force << "\n";
116
117     torque.x = this->pid_angular_x_.Update(current_pose.rot.GetRoll() -
118         desired_pose.rot.GetRoll(), _delta_time);
119     torque.y = this->pid_angular_y_.Update(current_pose.rot.GetPitch() -
120         desired_pose.rot.GetPitch(), _delta_time);
121     torque.z = this->pid_angular_z_.Update(current_pose.rot.GetYaw() -
122         desired_pose.rot.GetYaw(), _delta_time);
123
124     // this->link_->SetForce(force);
125     // this->link_->SetTorque(torque);
126     // this->link_->set
127
128     this->link_->SetWorldPose(desired_pose);
129     // this->link_->SetAngularVel(math::Vector3(0.0, 0.0, 0.0));
130     // this->link_->SetLinearVel(math::Vector3(0.0, 0.0, 0.0));
131 }
132
133 private:
134     std::string link_name_;
135     std::string target_frame_name_;
136     std::string reference_frame_name_;
137     ros::NodeHandle nh_;
138     ros::CallbackQueue queue_;
139     std::thread queue_thread_;
140     physics::LinkPtr link_;
141     event::ConnectionPtr update_connection_;
142     common::PID pid_linear_x_;
143     common::PID pid_linear_y_;
144     common::PID pid_linear_z_;
145     common::PID pid_angular_x_;
146     common::PID pid_angular_y_;
147     common::PID pid_angular_z_;
148     common::Time previous_sim_time_;
149     // Setup a P-controller
150     double P_;
151     double I_;
152     double D_;
153     tf2_ros::Buffer tfBuffer;
154     tf2_ros::TransformListener tfListener;
155
156     void QueueThread()
157     {
158         static const double timeout = 0.01;
159
160         while (this->nh_.ok())
161         {

```

```
154         this->queue_.callAvailable(ros::WallDuration(timeout));
155     }
156 }
157 };
158
159 GZ_REGISTER_MODEL_PLUGIN(ForceControllerPlugin)
160 }
```

83 plugins/LasagnaFactoryPlugin.hh

```
1  #ifndef PLUGINS_LASAGNAFACTORYPLUGIN_H
2  #define PLUGINS_LASAGNAFACTORYPLUGIN_H
3
4
5  #include <gazebo/gazebo.hh>
6
7  namespace gazebo {
8      class LasagnaFactoryPlugin : public WorldPlugin {
9          public: void Load(physics::WorldPtr _parent, sdf::ElementPtr _sdf)
10                 override;
11     };
12 }
13
14 #endif //PLUGINS_LASAGNAFACTORYPLUGIN_H
```

84 plugins/StickPlugin.hh

```
1  #ifndef PLUGINS_STICKPLUGIN_H
2  #define PLUGINS_STICKPLUGIN_H
3
4
5  #include <gazebo/gazebo.hh>
6  #include <gazebo/physics/Joint.hh>
7
8  namespace gazebo {
9      class StickPlugin : public ModelPlugin {
10     public:
11         StickPlugin();
12         void Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf) override;
13         void OnUpdate(const common::UpdateInfo & _info);
14         void Reset() override;
15         void CreateJoint();
16         void BreakJoint();
17
18     private:
19         physics::PhysicsEnginePtr physics;
20         physics::ModelPtr model;
21         physics::JointPtr joint;
22         physics::LinkPtr childLink;
23         physics::LinkPtr parentLink;
24         event::ConnectionPtr updateConnection;
25         double forceThreshold;
26     };
27 }
28
29
30 #endif //PLUGINS_STICKPLUGIN_H
```

85 plugins/OtherGraspPlugin.hh

```
1  #ifndef PLUGINS_OTHERGRASPPLUGIN_H
2  #define PLUGINS_OTHERGRASPPLUGIN_H
3
4  #include <string>
5
6  #include <gazebo/gazebo.hh>
7  #include <gazebo/sensors/sensors.hh>
8
9  namespace gazebo
10 {
11     /// \brief An example plugin for a contact sensor.
12     class OtherGraspPlugin : public SensorPlugin
13     {
14         /// \brief Constructor.
15         public: OtherGraspPlugin();
16
17         /// \brief Destructor.
18         public: virtual ~OtherGraspPlugin();
19
20         /// \brief Load the sensor plugin.
21         /// \param[in] _sensor Pointer to the sensor that loaded this plugin.
22         /// \param[in] _sdf SDF element that describes the plugin.
23         public: virtual void Load(sensors::SensorPtr _sensor, sdf::ElementPtr _sdf);
24
25         /// \brief Callback that receives the contact sensor's update signal.
26         private: virtual void OnUpdate();
27
28         /// \brief Pointer to the contact sensor
29         private: sensors::ContactSensorPtr parentSensor;
30
31         /// \brief Connection that maintains a link between the contact sensor's
32         /// updated signal and the OnUpdate callback.
33         private: event::ConnectionPtr updateConnection;
34     };
35 }
36 #endif
```

86 plugins/LasagnaFactoryPlugin.cc

```
1  /**
2   * Lasagna factory
3   *
4   * Credit:
5   * Based on Paulo Abelha's lasagna factory.
6   * https://github.com/pauloabelha/gazebo\_tasks/blob/master/cutting\_lasagna/
7   */
8  #include "LasagnaFactoryPlugin.hh"
9  #include <gazebo/physics/physics.hh>
10 #include <sstream>
11 #include <random>
12
13 using namespace gazebo;
14
15 GZ_REGISTER_WORLD_PLUGIN(LasagnaFactoryPlugin)
16
17 void LasagnaFactoryPlugin::Load(physics::WorldPtr _parent, sdf::ElementPtr _sdf)
18 {
19     math::Pose pose {0.0, 0.0, 0.0, 0.0, 0.0, 0.0};
20     math::Vector3 size {5.0, 5.0, 5.0};
21     double radius {0.01};
22     double mass {0.5};
23     double friction {0.4};
24     double friction2 {0.4};
25     double cfm {0.0};
26     double erp {0.0};
27     double jointDamping {0.0};
28     double jointFriction {0.0};
29     double spotProbability {0.4};
30
31     // Read values from XML if available
32     if (_sdf->HasElement("pose"))
33         pose = _sdf->GetElement("pose")->Get<math::Pose>();
34
35     if (_sdf->HasElement("size"))
36         size = _sdf->GetElement("size")->Get<math::Vector3>();
37
38     if (_sdf->HasElement("radius"))
39         radius = _sdf->GetElement("radius")->Get<double>();
40
41     if (_sdf->HasElement("mass"))
42         mass = _sdf->GetElement("mass")->Get<double>();
43
44     if (_sdf->HasElement("friction"))
45         friction = _sdf->GetElement("friction")->Get<double>();
46
47     if (_sdf->HasElement("friction2"))
48         friction2 = _sdf->GetElement("friction2")->Get<double>();
49
50     if (_sdf->HasElement("cfm"))
51         cfm = _sdf->GetElement("cfm")->Get<double>();
52
53     if (_sdf->HasElement("erp"))
54         erp = _sdf->GetElement("erp")->Get<double>();
```



```

110     xml << "\t\t\t\t\t</sphere>\n";
111     xml << "\t\t\t\t\t</geometry>\n";
112     xml << "\t\t\t\t\t<surface>\n";
113     xml << "\t\t\t\t\t<friction>\n";
114     xml << "\t\t\t\t\t\t\t<ode>\n";
115     xml << "\t\t\t\t\t\t\t\t\t<mu>" << friction << "</mu>\n";
116     xml << "\t\t\t\t\t\t\t\t\t\t\t<mu2>" << friction2 << "</mu2>\n";
117     xml << "\t\t\t\t\t\t\t\t\t</ode>\n";
118     xml << "\t\t\t\t\t\t\t\t\t<bullet>\n";
119     xml << "\t\t\t\t\t\t\t\t\t\t\t<friction>" << friction << "</friction>\n"
120     ;
121     xml << "\t\t\t\t\t\t\t\t\t\t\t<friction2>" << friction2 << "</friction2
122     >\n";
123     xml << "\t\t\t\t\t\t\t\t\t</bullet>\n";
124     xml << "\t\t\t\t\t\t\t\t\t</friction>\n";
125     xml << "\t\t\t\t\t\t\t\t\t<contact>\n";
126     xml << "\t\t\t\t\t\t\t\t\t\t\t<ode>\n";
127     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t<soft_cfm>" << cfm << "</soft_cfm>\n";
128     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<soft_erp>" << erp << "</soft_erp>\n";
129     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</ode>\n";
130     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<bullet>\n";
131     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<soft_cfm>" << cfm << "</soft_cfm>\n";
132     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<soft_erp>" << erp << "</soft_erp>\n";
133     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</bullet>\n";
134     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</contact>\n";
135     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</surface>\n";
136     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</collision>\n";
137     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<visual_name='visual'>\n";
138     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<geometry>\n";
139     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<sphere>\n";
140     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<radius>" << radius << "</radius>\n";
141     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</sphere>\n";
142     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</geometry>\n";
143     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<material>\n";
144     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<script>\n";
145     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<uri>file://media/materials/scripts/gazebo.
146     material</uri>\n";
147     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t<name>Gazebo/" << color << "</name>\n";
148     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</script>\n";
149     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</material>\n";
150     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</visual>\n";
151     xml << "\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t\t</link>\n";
152     }
153     }
154     }
155     for (int i = 0; i < size.x; ++i) {
156         for (int j = 0; j < size.y; ++j) {
157             for (int k = 1; k < size.z; ++k) {
158                 const auto currentIndex = std::to_string(i) + "_"
159                 + std::to_string(j) + "_"
160                 + std::to_string(k);
161                 const auto previousIndex = std::to_string(i) + "_"
162                 + std::to_string(j) + "_"
163                 + std::to_string(k - 1);
164                 xml << "\t\t\t<joint_name='joint_" << currentIndex << "_" <<

```



```

164         previousIndex << "'type='prismatic'>\n";
165     xml << "\t\t\t\t<pose>0 0 0.03 0 0 0</pose>\n";
166     xml << "\t\t\t\t<parent>link_" << previousIndex << "</parent>\n"
167         ;
168     xml << "\t\t\t\t<child>link_" << currentIndex << "</child>\n";
169     xml << "\t\t\t\t<axis>\n";
170     xml << "\t\t\t\t\t<dynamics>\n";
171     xml << "\t\t\t\t\t\t<damping>" << jointDamping << "</damping>\n"
172         ;
173     xml << "\t\t\t\t\t\t<friction>" << jointFriction << "</friction"
174         >\n";
175     xml << "\t\t\t\t\t\t</dynamics>\n";
176     xml << "\t\t\t\t\t\t<xyz>0 0 1</xyz>\n";
177     xml << "\t\t\t\t\t\t</axis>\n";
178     xml << "\t\t\t</joint>\n";
179     }
180 }
181
182 xml << "</model>\n";
183 xml << "</sdf>\n";
184
185 // Create SDF from the XML string
186 sdf::SDF model;
187 model.SetFromString(xml.str());
188
189 // Insert the SDF into the world in runtime
190 _parent->InsertModelSDF(model);
191 }

```

87 plugins/QGripPlugin.cc

```

1  #include "QGripPlugin.hh"
2
3  #include <gazebo/physics/physics.hh>
4  #include <string>
5
6  using namespace gazebo;
7
8  // Register this plugin with the simulator
9  GZ_REGISTER_MODEL_PLUGIN(QGripPlugin);
10
11 void QGripPlugin::Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf) {
12     const auto parentModel = _parent;
13     const auto world = parentModel->GetWorld();
14     const auto physics = world->GetPhysicsEngine();
15
16     const std::string childLinkName = _sdf->GetElement("childLinkName")->Get<std
        ::string>();
17     const std::string parentLinkName = _sdf->GetElement("parentLinkName")->Get<
        std::string>();
18
19     const auto parentLink = parentModel->GetLink(parentLinkName);
20     const auto childLink = boost::dynamic_pointer_cast<physics::Link>(world->
        GetEntity(childLinkName));
21
22     gzdbg << "QGrip␣parent␣link␣name:␣" << parentLink->GetScopedName() << "\n";
23     gzdbg << "QGrip␣child␣link␣name:␣" << childLink->GetScopedName() << "\n";
24
25     math::Pose relativePose;
26     math::Vector3 relativeTranslation;
27     math::Quaternion relativeRotation;
28     std::string relativeRotationStr;
29
30     if (_sdf->HasElement("relativeTranslation") && _sdf->HasElement("
        relativeRotationXYZW")) {
31         relativeTranslation = _sdf->GetElement("relativeTranslation")->Get<math::
            Vector3>();
32         relativeRotationStr = _sdf->GetElement("relativeRotationXYZW")->Get<std::
            string>();
33
34         std::istringstream i(relativeRotationStr);
35         double x,y,z,w;
36         i >> x;
37         i >> y;
38         i >> z;
39         i >> w;
40
41         relativeRotation = math::Quaternion(w, x, y, z);
42
43         gzdbg << "xyz:␣" << relativeTranslation.x << "␣" << relativeTranslation.y
            << "␣" << relativeTranslation.z << "␣" << "\n";
44         gzdbg << "xyzw:␣" << relativeRotation.x << "␣" << relativeRotation.y << "␣
            " << relativeRotation.z << "␣" << relativeRotation.w << "\n";
45
46         const auto parentPose = parentLink->GetWorldPose();
47         const auto childPose = math::Pose(parentPose.pos + (parentPose.rot.

```

```

48         RotateVector(relativeTranslation)), parentPose.rot * relativeRotation);
49     childLink->SetWorldPose(childPose);
50
51     gzdbg << "QGrip:␣Relative␣pose␣given,␣adjusting␣child␣pose␣\n"
52           << childPose << "\n";
53 } else {
54     relativePose = parentLink->GetWorldPose() - childLink->GetWorldPose();
55
56     gzdbg << "QGrip:␣Relative␣pose␣derived␣\n";
57 }
58
59 // Create joint
60 const auto joint = physics->CreateJoint("fixed", parentModel);
61 // Bullet physics needs accurate joint position
62 // ODE does't care
63 joint->Load(parentLink, childLink, math::Pose());
64 joint->Init();
65 joint->SetName("grip_joint_" + parentLink->GetScopedName() + "_" + childLink
66             ->GetScopedName());
67
68 childLink->SetGravityMode(false);
69 }

```

88 plugins/velocity_controller_plugin.cpp

```

1  #include <gazebo/common/Plugin.hh>
2  #include <gazebo/physics/physics.hh>
3  #include <ros/ros.h>
4  #include <ros/callback_queue.h>
5  #include <ros/subscribe_options.h>
6  #include <geometry_msgs/Twist.h>
7  #include <string>
8  #include <thread>
9  #include <mutex>
10
11 namespace gazebo
12 {
13   class ForceControllerPlugin : public ModelPlugin
14   {
15   public:
16     ForceControllerPlugin() : ModelPlugin()
17     {
18     }
19
20     ~ForceControllerPlugin()
21     {
22     }
23
24     void Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf)
25     {
26       // Make sure the ROS node for Gazebo has already been initialized
27       if (!ros::isInitialized())
28       {
29         ROS_FATAL_STREAM("A ROS node for Gazebo has not been initialized, unable
30           to load plugin.\n"
31           << "Load the Gazebo system plugin,\n"
32           libgazebo_ros_api_plugin.so' in the gazebo_ros package
33           ");
34
35         return;
36       }
37
38       // SDF values
39       this->link_name_ = _sdf->GetElement("linkName")->Get<std::string>();
40       this->topic_name_ = _sdf->GetElement("topicName")->Get<std::string>();
41
42       // if (_sdf->HasElement("gains"))
43       // {
44       //   const auto gains = _sdf->GetElement("gains");
45       //   const auto linearGains = gains->GetElement("linear");
46       //   this->linear_P_ = linearGains->GetElement("P")->Get<double>();
47       //   this->linear_I_ = linearGains->GetElement("I")->Get<double>();
48       //   this->linear_D_ = linearGains->GetElement("D")->Get<double>();
49       //   const auto angularGains = gains->GetElement("angular");
50       //   this->angular_P_ = angularGains->GetElement("P")->Get<double>();
51       //   this->angular_I_ = angularGains->GetElement("I")->Get<double>();
52       //   this->angular_D_ = angularGains->GetElement("D")->Get<double>();
53       // }
54       // else
55       // {
56       this->linear_P_ = 100.0;
57     }
58   }
59 }

```

```

53     this->linear_I_ = 0.0;
54     this->linear_D_ = 25.0;
55     this->angular_P_ = 0.001;
56     this->angular_I_ = 0.0;
57     this->angular_D_ = 0.0002;
58
59     // gzdbg << "Using default PID gains\n";
60     // }
61
62     // Link
63     this->link_ = _parent->GetLink(this->link_name_);
64
65     // Subscribe to the topic
66     auto so = ros::SubscribeOptions::create<geometry_msgs::Twist>(
67         this->topic_name_, 1,
68         boost::bind(&ForceControllerPlugin::UpdateObjectVelocity, this, _1),
69         ros::VoidPtr(), &this->queue_);
70     this->sub_ = this->nh_.subscribe(so);
71
72     // Custom Callback Queue
73     this->queue_thread_ = std::thread(boost::bind(&ForceControllerPlugin::
74         QueueThread, this));
75
76     // Listen to the update event. This event is broadcast every
77     // simulation iteration.
78     this->update_connection_ = event::Events::ConnectWorldUpdateBegin(
79         boost::bind(&ForceControllerPlugin::UpdateChild, this, _1));
80
81     this->pid_linear_x_ = common::PID(linear_P_, linear_I_, linear_D_);
82     this->pid_linear_y_ = common::PID(linear_P_, linear_I_, linear_D_);
83     this->pid_linear_z_ = common::PID(linear_P_, linear_I_, linear_D_);
84     this->pid_angular_x_ = common::PID(angular_P_, angular_I_, angular_D_,
85         0.001, -0.001);
86     this->pid_angular_y_ = common::PID(angular_P_, angular_I_, angular_D_,
87         0.001, -0.001);
88     this->pid_angular_z_ = common::PID(angular_P_, angular_I_, angular_D_,
89         0.001, -0.001);
90 }
91
92 void UpdateObjectVelocity(const geometry_msgs::Twist::ConstPtr &_msg)
93 {
94     std::lock_guard<std::mutex> lock{this->mutex_};
95
96     this->desired_twist_.linear.x = _msg->linear.x;
97     this->desired_twist_.linear.y = _msg->linear.y;
98     this->desired_twist_.linear.z = _msg->linear.z;
99     this->desired_twist_.angular.x = _msg->angular.x;
100    this->desired_twist_.angular.y = _msg->angular.y;
101    this->desired_twist_.angular.z = _msg->angular.z;
102 }
103
104 void UpdateChild(const common::UpdateInfo &_info)
105 {
106     const auto current_sim_time = _info.simTime;
107
108     if (current_sim_time < 1)
109         return;

```

```

106
107     const auto delta_sim_time = current_sim_time - this->previous_sim_time_;
108
109     UpdateObjectForces(delta_sim_time);
110 }
111
112 void UpdateObjectForces(const common::Time _delta_time)
113 {
114     std::lock_guard<std::mutex> lock{this->mutex_};
115
116     auto current_linear_vel = this->link_->GetWorldLinearVel();
117     auto current_angular_vel = this->link_->GetWorldAngularVel();
118
119     math::Vector3 force{0.0, 0.0, 0.0};
120     math::Vector3 torque{0.0, 0.0, 0.0};
121
122     force.x = this->pid_linear_x_.Update(current_linear_vel.x - this->
        desired_twist_.linear.x, _delta_time);
123     force.y = this->pid_linear_y_.Update(current_linear_vel.y - this->
        desired_twist_.linear.y, _delta_time);
124     force.z = this->pid_linear_z_.Update(current_linear_vel.z - this->
        desired_twist_.linear.z, _delta_time);
125
126     // Gazebo freaks out :/
127     // torque.x = this->pid_angular_x_.Update(current_angular_vel.x - this->
        desired_twist_.angular.x, _delta_time);
128     // torque.y = this->pid_angular_y_.Update(current_angular_vel.y - this->
        desired_twist_.angular.y, _delta_time);
129     // torque.z = this->pid_angular_z_.Update(current_angular_vel.z - this->
        desired_twist_.angular.z, _delta_time);
130
131     this->link_->SetForce(force);
132     this->link_->SetAngularVel(math::Vector3{this->desired_twist_.angular.x,
        this->desired_twist_.angular.y, this->desired_twist_.angular.z});
133 }
134
135 private:
136     std::string link_name_;
137     std::string topic_name_;
138     ros::NodeHandle nh_;
139     ros::Subscriber sub_;
140     ros::CallbackQueue queue_;
141     std::thread queue_thread_;
142     physics::LinkPtr link_;
143     std::mutex mutex_;
144     geometry_msgs::Twist desired_twist_;
145     event::ConnectionPtr update_connection_;
146     common::PID pid_linear_x_;
147     common::PID pid_linear_y_;
148     common::PID pid_linear_z_;
149     common::PID pid_angular_x_;
150     common::PID pid_angular_y_;
151     common::PID pid_angular_z_;
152     common::Time previous_sim_time_;
153     // Setup a P-controller
154     double linear_P_;
155     double linear_I_;

```

```

156     double linear_D_;
157     double angular_P_;
158     double angular_I_;
159     double angular_D_;
160
161     void QueueThread()
162     {
163         static const double timeout = 0.01;
164
165         while (this->nh_.ok())
166         {
167             this->queue_.callAvailable(ros::WallDuration(timeout));
168         }
169     }
170 };
171
172 GZ_REGISTER_MODEL_PLUGIN(ForceControllerPlugin)
173 }

```

89 plugins/TiltGrabPlugin.hh

```
1  #ifndef PLUGINS_TILTGRABPLUGIN_H
2  #define PLUGINS_TILTGRABPLUGIN_H
3
4
5  #include <gazebo/gazebo.hh>
6  #include <gazebo/physics/Joint.hh>
7  #include <gazebo/sensors/sensors.hh>
8
9  namespace gazebo {
10     class TiltGrabPlugin : public ModelPlugin {
11     public:
12         TiltGrabPlugin();
13         void Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf) override;
14         void OnUpdate(const common::UpdateInfo & _info);
15         void Reset() override;
16         void CreateFirstJoint();
17         void CreateSecondJoints();
18         void BreakJoint();
19
20     private:
21         physics::PhysicsEnginePtr physics;
22         physics::ModelPtr model;
23         physics::ModelPtr book_model;
24         physics::JointPtr joint1;
25         physics::JointPtr joint2;
26         physics::JointPtr joint3;
27         physics::LinkPtr childLink1;
28         physics::LinkPtr childLink2;
29         physics::LinkPtr childLink3;
30         physics::LinkPtr parentLink;
31         event::ConnectionPtr updateConnection;
32         int grabPhase;
33         sensors::ContactSensorPtr parentSensor;
34         physics::ContactManager *cMgr;
35         bool curcontact;
36         bool left_finger_touching;
37         bool right_fingers_touching;
38         double goalZ;
39     };
40 }
41
42
43 #endif //PLUGINS_TILTGRABPLUGIN_H
```


90 plugins/TiltGrabPlugin.cc

```
1  #include "TiltGrabPlugin.hh"
2
3  #include <gazebo/physics/physics.hh>
4  #include <gazebo/sensors/sensors.hh>
5  #include <string>
6  #include <ros/ros.h>
7
8  using namespace gazebo;
9
10 // Register this plugin with the simulator
11 GZ_REGISTER_MODEL_PLUGIN(TiltGrabPlugin);
12
13
14 TiltGrabPlugin::TiltGrabPlugin(): ModelPlugin(), joint1(nullptr) {
15
16 }
17
18 void TiltGrabPlugin::Load(physics::ModelPtr _parent, sdf::ElementPtr _sdf) {
19     ROS_INFO("Hello World!");
20     ROS_DEBUG("Hello World!");
21     this->model = _parent;
22     const auto world = this->model->GetWorld();
23     this->physics = world->GetPhysicsEngine();
24     this->cMgr = this->physics->GetContactManager();
25     if (!this->cMgr)
26     {
27         std::cout << "oops\n";
28         gzerr << "nullptr.\n";
29         return;
30     }
31     //sensors::SensorManager *mgr = gazebo::sensors::SensorManager::Instance();
32
33     const std::string childLinkName1 = _sdf->GetElement("childLinkName1")->Get<
34         std::string>();
35     const std::string childLinkName2 = _sdf->GetElement("childLinkName2")->Get<
36         std::string>();
37     const std::string childLinkName3 = _sdf->GetElement("childLinkName3")->Get<
38         std::string>();
39     const std::string parentLinkName = _sdf->GetElement("parentLinkName")->Get<
40         std::string>();
41     const std::string SensorName = _sdf->GetElement("sensorName")->Get<std::
42         string>();
43     //int y = model->GetSensorCount();
44     //std::cout << y << "\n";
45     //std::cout << SensorName << "\n";
46     //sensors::Sensor_V all = mgr->GetSensors();
47     //std::cout << "used mgr \n";
48     //std::string name;
49     //std::cout << all.size() << "\n";
50     //for(int i = 0; i < all.size(); i++)
51     //{
52     //    name = all[i]->Name();
53     //    std::cout << name << "\n";
54     //}
55     this->grabPhase = 0;
```

```

51
52     this->parentLink = this->model->GetLink(parentLinkName);
53     this->childLink1 = boost::dynamic_pointer_cast<physics::Link>(world->
54         GetEntity(childLinkName1));
55     this->childLink2 = boost::dynamic_pointer_cast<physics::Link>(world->
56         GetEntity(childLinkName2));
57     this->childLink3 = boost::dynamic_pointer_cast<physics::Link>(world->
58         GetEntity(childLinkName3));
59     this->book_model = this->parentLink->GetModel();
60
61     this->left_finger_touching = false;
62     this->right_fingers_touching = false;
63
64     const gazebo::math::Pose &modelstart = this->book_model->GetWorldPose();
65     std::cout << modelstart.pos;
66     this->goalZ = modelstart.pos.z;
67     this->goalZ += 0.05;
68
69
70     //sensors::SensorPtr SensorPointer = mgr->GetSensor(SensorName);
71     //if (!SensorPointer)
72     //    {
73     //        std::cout << "oops \n";
74     //        gzerr << "nullptr. \n";
75     //        return;
76     //    }
77     //this->parentSensor = std::dynamic_pointer_cast<sensors::ContactSensor>(
78         SensorPointer);
79
80     //this->updateConnection = this->parentSensor->ConnectUpdated(std::bind(&
81         TiltGrabPlugin::OnUpdate, this));
82     //this->parentSensor->SetActive(true);
83     this->curcontact = true;
84     this->updateConnection = event::Events::ConnectWorldUpdateBegin(
85         boost::bind(&TiltGrabPlugin::OnUpdate, this, _1));
86 }
87
88 void TiltGrabPlugin::OnUpdate(const common::UpdateInfo &_info) {
89     if (_info.simTime < 1.0) {
90         // Let the stage settle down and position objects
91         return;
92     }
93     std::vector<physics::Contact*> contacts;
94     //physics::Contact contacts;
95     //msgs::Contacts contacts;
96     contacts = this->cMgr->GetContacts();
97     int number = this->cMgr->GetContactCount();
98     for (unsigned int i = 0; i < number; ++i)
99     {
100         physics::Collision *col1 = contacts[i]->collision1;
101         physics::Collision *col2 = contacts[i]->collision2;
102         physics::ModelPtr mod1 = col1->GetModel();

```

```

103     physics::ModelPtr mod2 = col2->GetModel();
104     std::string name1 = mod1->GetName();
105     std::string name2 = mod2->GetName();
106     //std::cout << "Collision between[" << name1 << "]" and [" << name2 <<
        "]" \n";
107     this->curcontact = true;
108     if (name1 == "left_ee" || name2 == "left_ee")
109     {
110         this->left_finger_touching = true;
111         //std::cout << "Collision between[" << name1 << "]" and [" << name2
            << "]" \n";
112     }
113     if (name1 == "right_ee" || name2 == "right_ee")
114     {
115         this->right_fingers_touching = true;
116         //std::cout << "Collision between[" << name1 << "]" and [" << name2
            << "]" \n";
117     }
118     if (name1 == "right_ee_2" || name2 == "right_ee_2")
119     {
120         this->right_fingers_touching = true;
121         //std::cout << "Collision between[" << name1 << "]" and [" << name2
            << "]" \n";
122     }
123 }
124
125 if (number == 0 and curcontact)
126 {
127     //std::cout << "no Collisions \n";
128     //std::cout << contacts << "\n";
129     this->curcontact = false;
130 }
131
132 if (this->grabPhase == 0){
133     if (this->left_finger_touching){
134         this->CreateFirstJoint();
135         this->grabPhase = 1;
136         std::cout << "made first joint \n";
137         gzdbg << "made first joint \n";
138     }
139 }
140
141 if (this->grabPhase == 1){
142     if (this->right_fingers_touching){
143         this->BreakJoint();
144         this->CreateSecondJoints();
145         this->grabPhase = 2;
146         std::cout << "made second joints \n";
147         gzdbg << "made second joints \n";
148     }
149 }
150 this->left_finger_touching = false;
151 this->right_fingers_touching = false;
152 if (this->grabPhase == 2){
153     const gazebo::math::Pose &modelend = this->book_model->GetWorldPose();
154     if (modelend.pos.z > this->goalZ){
155         ROS_INFO("Experiment Success");

```

```

156         gzdbg << "Experiment_Success_\n";
157         //ROS_INFO(modelend.pos.z);
158         this->grabPhase = 3;
159     }
160
161 }
162 }
163
164 void TiltGrabPlugin::Reset() {
165     if (this->joint1 != nullptr) {
166         this->BreakJoint();
167     }
168     if (this->joint2 != nullptr) {
169         this->joint2->Detach();
170         this->joint2 = nullptr;
171         this->joint3->Detach();
172         this->joint3 = nullptr;
173
174         // Enable gravity on the childLink
175         this->parentLink->SetGravityMode(true);
176
177         event::Events::DisconnectWorldUpdateBegin(this->updateConnection);
178         this->updateConnection = nullptr;
179     }
180 }
181
182 void TiltGrabPlugin::CreateFirstJoint() {
183     this->joint1 = this->physics->CreateJoint("fixed", this->model);
184     // Bullet physics needs accurate joint position
185     // ODE doesn't care
186     this->joint1->Load(this->parentLink, this->childLink1, this->parentLink->
        GetWorldPose() - this->childLink1->GetWorldPose());
187     this->joint1->Init();
188     this->joint1->SetProvideFeedback(true);
189     this->joint1->SetName("tilt_joint1_" + this->parentLink->GetScopedName() + "
        _" + this->childLink1->GetScopedName());
190
191     // Disable gravity on the butter link
192     this->parentLink->SetGravityMode(false);
193     this->grabPhase = 1;
194
195     this->updateConnection = event::Events::ConnectWorldUpdateBegin(
        boost::bind(&TiltGrabPlugin::OnUpdate, this, _1));
196 }
197
198
199 void TiltGrabPlugin::CreateSecondJoints() {
200     this->joint2 = this->physics->CreateJoint("fixed", this->model);
201     // Bullet physics needs accurate joint position
202     // ODE doesn't care
203     this->joint2->Load(this->parentLink, this->childLink2, this->parentLink->
        GetWorldPose() - this->childLink2->GetWorldPose());
204     this->joint2->Init();
205     this->joint2->SetProvideFeedback(true);
206     this->joint2->SetName("grab_joint2_" + this->parentLink->GetScopedName() + "
        _" + this->childLink2->GetScopedName());
207
208     this->joint3 = this->physics->CreateJoint("fixed", this->model);

```

```

209 // Bullet physics needs accurate joint position
210 // ODE does't care
211 this->joint3->Load(this->parentLink, this->childLink3, this->parentLink->
    GetWorldPose() - this->childLink3->GetWorldPose());
212 this->joint3->Init();
213 this->joint3->SetProvideFeedback(true);
214 this->joint3->SetName("grab_joint3_" + this->parentLink->GetScopedName() + "
    _" + this->childLink3->GetScopedName());
215
216 // Disable gravity on the butter link
217 this->parentLink->SetGravityMode(false);
218 this->grabPhase = 2;
219
220 this->updateConnection = event::Events::ConnectWorldUpdateBegin(
221     boost::bind(&TiltGrabPlugin::OnUpdate, this, _1));
222 }
223
224 void TiltGrabPlugin::BreakJoint() {
225     this->joint1->Detach();
226     this->joint1 = nullptr;
227
228     // Enable gravity on the childLink
229     this->parentLink->SetGravityMode(true);
230
231     event::Events::DisconnectWorldUpdateBegin(this->updateConnection);
232     this->updateConnection = nullptr;
233 }

```

91 test.sh

```
1  #!/bin/bash
2
3
4  #worlds=(grabbing_book2 grabbing_book2 grabbing_book2 grabbing_book2
5           grabbing_book2 grabbing_book2 grabbing_book2 grabbing_book2
6           grabbing_book2 grabbing_book2
7           #freezer_box freezer_box freezer_box freezer_box freezer_box
8           freezer_box freezer_box freezer_box freezer_box freezer_box
9           freezer_box
10          #freezer_box2 freezer_box2 freezer_box2 freezer_box2
11          freezer_box2 freezer_box2 freezer_box2 freezer_box2
12          freezer_box2 freezer_box2 freezer_box2
13          #freezer_box3 freezer_box3 freezer_box3 freezer_box3
14          freezer_box3 freezer_box3 freezer_box3 freezer_box3
15          freezer_box3 freezer_box3 freezer_box3
16          #freezer_box4 freezer_box4 freezer_box4 freezer_box4
17          freezer_box4 freezer_box4 freezer_box4 freezer_box4
18          freezer_box4 freezer_box4 freezer_box4
19          #freezer_box5 freezer_box5 freezer_box5 freezer_box5
20          freezer_box5 freezer_box5 freezer_box5 freezer_box5
21          freezer_box5 freezer_box5 freezer_box5
22          #freezer_box6 freezer_box6 freezer_box6 freezer_box6
23          freezer_box6 freezer_box6 freezer_box6 freezer_box6
24          freezer_box6 freezer_box6 freezer_box6
25          #freezer_box7 freezer_box7 freezer_box7 freezer_box7
26          freezer_box7 freezer_box7 freezer_box7 freezer_box7
27          freezer_box7 freezer_box7 freezer_box7 )
28  worlds=(grabbing_book grabbing_book grabbing_book grabbing_book
29           grabbing_book grabbing_book grabbing_book grabbing_book grabbing_book
30           grabbing_book grabbing_book
31           grabbing_book2 grabbing_book2 grabbing_book2 grabbing_book2
32           grabbing_book2 grabbing_book2 grabbing_book2 grabbing_book2
33           grabbing_book2 grabbing_book2 grabbing_book2
34           grabbing_book3 grabbing_book3 grabbing_book3 grabbing_book3
35           grabbing_book3 grabbing_book3 grabbing_book3 grabbing_book3
36           grabbing_book3 grabbing_book3 grabbing_book3
37           grabbing_book4 grabbing_book4 grabbing_book4 grabbing_book4
38           grabbing_book4 grabbing_book4 grabbing_book4 grabbing_book4
39           grabbing_book4 grabbing_book4 grabbing_book4
40           grabbing_book5 grabbing_book5 grabbing_book5 grabbing_book5
41           grabbing_book5 grabbing_book5 grabbing_book5 grabbing_book5
42           grabbing_book5 grabbing_book5 grabbing_book5
43           grabbing_book6 grabbing_book6 grabbing_book6 grabbing_book6
44           grabbing_book6 grabbing_book6 grabbing_book6 grabbing_book6
45           grabbing_book6 grabbing_book6 grabbing_book6
46           grabbing_book7 grabbing_book7 grabbing_book7 grabbing_book7
47           grabbing_book7 grabbing_book7 grabbing_book7 grabbing_book7
48           grabbing_book7 grabbing_book7 grabbing_book7
49           grabbing_book8 grabbing_book8 grabbing_book8 grabbing_book8
50           grabbing_book8 grabbing_book8 grabbing_book8 grabbing_book8
51           grabbing_book8 grabbing_book8 grabbing_book8 )
52
53  #experiments=(book_on_shelf book_on_shelf book_on_shelf book_on_shelf
54               book_on_shelf book_on_shelf book_on_shelf book_on_shelf
55               book_on_shelf
```

```

    book_on_shelf book_on_shelf freezer_box freezer_box freezer_box
    freezer_box freezer_box freezer_box freezer_box freezer_box
    freezer_box freezer_box freezer_box
23     #freezer_box2 freezer_box2 freezer_box2 freezer_box2
        freezer_box2 freezer_box2 freezer_box2 freezer_box2
        freezer_box2 freezer_box2 freezer_box2
24     #freezer_box3 freezer_box3 freezer_box3 freezer_box3
        freezer_box3 freezer_box3 freezer_box3 freezer_box3
        freezer_box3 freezer_box3 freezer_box3
25     #freezer_box4 freezer_box4 freezer_box4 freezer_box4
        freezer_box4 freezer_box4 freezer_box4 freezer_box4
        freezer_box4 freezer_box4 freezer_box4
26     #freezer_box5 freezer_box5 freezer_box5 freezer_box5
        freezer_box5 freezer_box5 freezer_box5 freezer_box5
        freezer_box5 freezer_box5 freezer_box5
27     #freezer_box6 freezer_box6 freezer_box6 freezer_box6
        freezer_box6 freezer_box6 freezer_box6 freezer_box6
        freezer_box6 freezer_box6 freezer_box6
28     #freezer_box7 freezer_box7 freezer_box7 freezer_box7
        freezer_box7 freezer_box7 freezer_box7 freezer_box7
        freezer_box7 freezer_box7 freezer_box7 )
29 experiments=(book_on_shelf book_on_shelf book_on_shelf book_on_shelf
    book_on_shelf book_on_shelf book_on_shelf book_on_shelf book_on_shelf
    book_on_shelf book_on_shelf
30     book_on_shelf2 book_on_shelf2 book_on_shelf2 book_on_shelf2
        book_on_shelf2 book_on_shelf2 book_on_shelf2 book_on_shelf2
        book_on_shelf2 book_on_shelf2 book_on_shelf2
31     book_on_shelf3 book_on_shelf3 book_on_shelf3 book_on_shelf3
        book_on_shelf3 book_on_shelf3 book_on_shelf3 book_on_shelf3
        book_on_shelf3 book_on_shelf3 book_on_shelf3
32     book_on_shelf4 book_on_shelf4 book_on_shelf4 book_on_shelf4
        book_on_shelf4 book_on_shelf4 book_on_shelf4 book_on_shelf4
        book_on_shelf4 book_on_shelf4 book_on_shelf4
33     book_on_shelf5 book_on_shelf5 book_on_shelf5 book_on_shelf5
        book_on_shelf5 book_on_shelf5 book_on_shelf5 book_on_shelf5
        book_on_shelf5 book_on_shelf5 book_on_shelf5
34     book_on_shelf6 book_on_shelf6 book_on_shelf6 book_on_shelf6
        book_on_shelf6 book_on_shelf6 book_on_shelf6 book_on_shelf6
        book_on_shelf6 book_on_shelf6 book_on_shelf6
35     book_on_shelf7 book_on_shelf7 book_on_shelf7 book_on_shelf7
        book_on_shelf7 book_on_shelf7 book_on_shelf7 book_on_shelf7
        book_on_shelf7 book_on_shelf7 book_on_shelf7
36     book_on_shelf8 book_on_shelf8 book_on_shelf8 book_on_shelf8
        book_on_shelf8 book_on_shelf8 book_on_shelf8 book_on_shelf8
        book_on_shelf8 book_on_shelf8 book_on_shelf8 )
37 index=0
38
39
40 while [ $index -lt 88 ]; do
41
42     gnome-terminal -e "timeout 180s roslaunch skill_transfer simulation.
        launch_world:=${worlds[$index]}" #kill node?
43     sleep 10s;
44     gnome-terminal -e "timeout 100s roslaunch skill_transfer experiment.
        launch_task:=tiltgrabbing_robot:=free_ees_setup:=${experiments[$index
        ]}"
45     sleep 190;

```

```

46
47     echo -e "␣$index␣:␣\n" >>output.txt
48     echo -e "␣${worlds[$index]}␣:␣\n" >>bookoutput.txt
49     echo -e "␣${experiments[$index]}␣:␣\n" >>bookoutput.txt
50     while read -r row; do
51     echo -e "$row␣\n" >>output.txt #depends on the format
52     done < ~/.gazebo/server-11345/default.log
53     echo -e "
        *****\
        n␣" >>output.txt
54     echo -e "\n\n\nn␣" >>output.txt
55     index=$((index+1))
56
57     #     echo "Trial␣NO.$index␣accomplished"
58     #     sleep 5s;
59     done

```


92 package.xml

```
1  <?xml version="1.0"?>
2  <package>
3    <name>skill_transfer</name>
4    <version>0.0.0</version>
5    <description>The skill_transfer package</description>
6
7    <maintainer email="lubiluk@todo.todo">lubiluk</maintainer>
8
9    <license>TODO</license>
10
11    <buildtool_depend>catkin</buildtool_depend>
12
13    <build_depend>roscpp</build_depend>
14    <build_depend>std_msgs</build_depend>
15    <build_depend>gazebo_msgs</build_depend>
16    <build_depend>giskard_core</build_depend>
17    <build_depend>giskard_ros_utils</build_depend>
18    <build_depend>kdl_conversions</build_depend>
19    <build_depend>visualization_msgs</build_depend>
20    <build_depend>actionlib</build_depend>
21    <build_depend>actionlib_msgs</build_depend>
22    <build_depend>message_generation</build_depend>
23    <build_depend>gazebo_ros</build_depend>
24    <build_depend>yaml-cpp</build_depend>
25    <build_depend>sensor_msgs</build_depend>
26    <build_depend>tf2_ros</build_depend>
27
28    <run_depend>roscpp</run_depend>
29    <run_depend>std_msgs</run_depend>
30    <run_depend>gazebo_msgs</run_depend>
31    <run_depend>gazebo_plugins</run_depend>
32    <run_depend>gazebo_ros</run_depend>
33    <run_depend>giskard_core</run_depend>
34    <run_depend>giskard_ros_utils</run_depend>
35    <run_depend>kdl_conversions</run_depend>
36    <run_depend>visualization_msgs</run_depend>
37    <run_depend>actionlib</run_depend>
38    <run_depend>actionlib_msgs</run_depend>
39    <run_depend>message_runtime</run_depend>
40    <run_depend>gazebo_ros</run_depend>
41    <run_depend>yaml-cpp</run_depend>
42    <run_depend>sensor_msgs</run_depend>
43    <run_depend>tf2_ros</run_depend>
44
45    <export>
46      <gazebo_ros plugin_path="${prefix}/lib" gazebo_model_path="${prefix}/models"
47      />
48    </export>
49  </package>
```

93 motions/scraping_edge_contact.yaml

```

1  scope:
2    # weights
3    - controllable-weight: 0.001 # mu * 1
4    - constraint-weight: 10.001 # mu + 10
5
6    # definition of object frames
7    - target-object-frame:
8      frame-mul:
9        - right_ee
10       - target-object-grasp # This has to be provided
11
12    - tool-frame:
13      frame-mul:
14        - left_ee
15        - tool-grasp # This has to be provided
16
17    # definition of features
18    - tool-point:
19      transform-vector: [tool-frame, tool-heel]
20    - target-object-point:
21      transform-vector: [target-object-frame, edge-point]
22
23    # distance definition
24    - distance: {vector-sub: [target-object-point, tool-point]}
25
26    # rotation definition
27    - l_goal_rot:
28      rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
29    - l_rot: {orientation-of: tool-frame}
30    - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
31      l_rot}, l_goal_rot]}}}
32    - l_rot_scaling:
33      double-if:
34        - {double-sub: [rot_thresh, l_rot_error]}
35        - 1
36        - {double-div: [rot_thresh, l_rot_error]}
37    - l_intermediate_goal_rot:
38      slerp:
39        - l_rot
40        - l_goal_rot
41        - l_rot_scaling
42    - l_rot_control:
43      scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
44      mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]}
45
46  soft-constraints:
47    - soft-constraint:
48      - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
49      boundary
50      - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
51      boundary
52      - constraint-weight # weight of this constraint
53      - {x-coord: distance} # expression used for Jacobian calculation
54      - contact_x # name of expression reported
55    - soft-constraint:

```

```

52     - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
        boundary
53     - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
        boundary
54     - constraint-weight # weight of this constraint
55     - {y-coord: distance} # expression used for Jacobian calcuation
56     - contact_y # name of expression reported
57 - soft-constraint:
58     - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
        boundary
59     - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
        boundary
60     - constraint-weight # weight of this constraint
61     - {z-coord: distance} # expression used for Jacobian calcuation
62     - contact_z # name of expression reported
63 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
        weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
        slack]
64 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
        weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
        slack]
65 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
        weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
        slack]

```

94 motions/cutting_{pull}.yaml

```

1 scope:
2   # weights
3   - controllable-weight: 0.001 # mu * 1
4   - constraint-weight: 10.001 # mu + 10
5
6   # definition of object frames
7   - target-object-frame:
8     frame:
9     - quaternion: [0, 0, 0, 1]
10    - vector3: [0, 0, 1.03]
11
12   - tool-frame:
13     frame-mul:
14     - left_ee
15     - tool-grasp # This has to be provided
16
17   # definition of features
18   - tool-point:
19     transform-vector: [tool-frame, blade-point]
20   - target-object-point:
21     transform-vector:
22     - target-object-frame
23     - {vector3: [-0.30, 0, -0.01]} # 20 cm above the object
24
25   # expressions used in constraints
26   - distance: {vector-sub: [target-object-point, tool-point]}
27
28   - l_goal_rot:
29     rotation-mul:
30     - {axis-angle: [unit-z, 3.14]}
31     - {axis-angle: [unit-y, 0]}
32     - {axis-angle: [unit-x, 1.57]}
33   - l_rot: {orientation-of: tool-frame}
34   - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
35     l_rot}, l_goal_rot]}}}
36   - l_rot_scaling:
37     double-if:
38     - {double-sub: [rot_thresh, l_rot_error]}
39     - 1
40     - {double-div: [rot_thresh, l_rot_error]}
41   - l_intermediate_goal_rot:
42     slerp:
43     - l_rot
44     - l_goal_rot
45     - l_rot_scaling
46   - l_rot_control:
47     scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
48     mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
49
50 soft-constraints:
51   - soft-constraint:
52     - {double-sub: [-0.005, {x-coord: distance}]} # control law for lower
53     boundary
54     - {double-sub: [0.005, {x-coord: distance}]} # control law for upper
55     boundary

```

```

52     - constraint-weight # weight of this constraint
53     - {x-coord: distance} # expression used for Jacobian calcuation
54     - contact_x # name of expression reported
55 - soft-constraint:
56     - {double-sub: [-0.005, {y-coord: distance}]} # control law for lower
        boundary
57     - {double-sub: [0.005, {y-coord: distance}]} # control law for upper
        boundary
58     - constraint-weight # weight of this constraint
59     - {y-coord: distance} # expression used for Jacobian calcuation
60     - contact_y # name of expression reported
61 - soft-constraint:
62     - {double-sub: [-0.005, {z-coord: distance}]} # control law for lower
        boundary
63     - {double-sub: [0.005, {z-coord: distance}]} # control law for upper
        boundary
64     - constraint-weight # weight of this constraint
65     - {z-coord: distance} # expression used for Jacobian calcuation
66     - contact_z # name of expression reported
67 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
    weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
    slack]
68 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
    weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
    slack]
69 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
    weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
    slack]

```

95 motions/tilting_tilt.yaml

```

1  scope:
2    # weights
3    - controllable-weight: 0.001 # mu * 1
4    - constraint-weight: 10.001 # mu + 10
5
6    # definition of object frames
7    - target-object-frame:
8      frame-mul:
9        - target-object-grasp # This has to be provided
10
11    - tool-frame:
12      frame-mul:
13        - left_ee
14        - tool-grasp # This has to be provided
15
16    # definition of features
17    - tool-point:
18      transform-vector: [tool-frame, {vector3: [0, 0, 0.025]}]
19    - target-object-point:
20      vector-add:
21        - transform-vector: [target-object-frame, {vector3: [0.05, 0, 0.0]}]
22        - {vector3: [0.0, 0, 0.0]} # 5 cm beneath the edge
23
24    # expressions used in constraints
25    - distance: {vector-sub: [target-object-point, tool-point]}
26
27    - l_goal_rot:
28      rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
29    - l_rot: {orientation-of: tool-frame}
30    - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
31      l_rot}, l_goal_rot]}}}
32    - l_rot_scaling:
33      double-if:
34        - {double-sub: [rot_thresh, l_rot_error]}
35        - 1
36        - {double-div: [rot_thresh, l_rot_error]}
37    - l_intermediate_goal_rot:
38      slerp:
39        - l_rot
40        - l_goal_rot
41        - l_rot_scaling
42    - l_rot_control:
43      scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
44      mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]}
45
46  soft-constraints:
47    - soft-constraint:
48      - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
49      boundary
50      - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
51      boundary
52      - constraint-weight # weight of this constraint
53      - {x-coord: distance} # expression used for Jacobian calculation
54      - contact_x # name of expression reported
55    - soft-constraint:

```

```

52     - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
        boundary
53     - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
        boundary
54     - constraint-weight # weight of this constraint
55     - {y-coord: distance} # expression used for Jacobian calculation
56     - contact_y # name of expression reported
57 - soft-constraint:
58     - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
        boundary
59     - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
        boundary
60     - constraint-weight # weight of this constraint
61     - {z-coord: distance} # expression used for Jacobian calculation
62     - contact_z # name of expression reported
63 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
        weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
        slack]
64 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
        weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
        slack]
65 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
        weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
        slack]

```

96 motions/scooping_insert.yaml

```

1  scope:
2    # weights
3    - controllable-weight: 0.001 # mu * 1
4    - constraint-weight: 10.001 # mu + 10
5
6    # definition of object frames
7    - target-object-frame:
8      frame-mul:
9        - right_ee
10       - tool-grasp # This has to be provided
11
12    - tool-frame:
13      frame-mul:
14        - left_ee
15        - target-object-grasp # This has to be provided
16
17    # definition of features
18    - tool-point:
19      transform-vector: [tool-frame, {vector3: [-0.1149, -0.005, -0.0118]}]
20    - target-object-point:
21      transform-vector: [target-object-frame, {vector3: [0.018, 0.02, 0.0]}]
22
23    # expressions used in constraints
24    - distance: {vector-sub: [target-object-point, tool-point]}
25
26    - l_goal_rot:
27      rotation-mul:
28        - {axis-angle: [unit-z, 0]}
29        - {axis-angle: [unit-y, -1.57]}
30        - {axis-angle: [unit-x, -1.57]}
31    - l_rot: {orientation-of: tool-frame}
32    - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
33      l_rot}, l_goal_rot]}}}
34    - l_rot_scaling:
35      double-if:
36        - {double-sub: [rot_thresh, l_rot_error]}
37        - 1
38        - {double-div: [rot_thresh, l_rot_error]}
39    - l_intermediate_goal_rot:
40      slerp:
41        - l_rot
42        - l_goal_rot
43        - l_rot_scaling
44    - l_rot_control:
45      scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
46        mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
47
48  soft-constraints:
49    - soft-constraint:
50      - {double-sub: [-0.005, {x-coord: distance}]} # control law for lower
51        boundary
52      - {double-sub: [0.005, {x-coord: distance}]} # control law for upper
53        boundary
54      - constraint-weight # weight of this constraint
55      - {x-coord: distance} # expression used for Jacobian calculation

```



```

52     - contact_x # name of expression reported
53 - soft-constraint:
54     - {double-sub: [-0.005, {y-coord: distance}]} # control law for lower
      boundary
55     - {double-sub: [0.005, {y-coord: distance}]} # control law for upper
      boundary
56     - constraint-weight # weight of this constraint
57     - {y-coord: distance} # expression used for Jacobian calculation
58     - contact_y # name of expression reported
59 - soft-constraint:
60     - {double-sub: [-0.005, {z-coord: distance}]} # control law for lower
      boundary
61     - {double-sub: [0.005, {z-coord: distance}]} # control law for upper
      boundary
62     - constraint-weight # weight of this constraint
63     - {z-coord: distance} # expression used for Jacobian calculation
64     - contact_z # name of expression reported
65 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
      weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
      slack]
66 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
      weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
      slack]
67 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
      weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
      slack]

```

97 motions/tilting_{position}front₂.yaml

```

1  scope:
2    # weights
3    - controllable-weight: 0.001 # mu * 1
4    - constraint-weight: 10.001 # mu + 10
5
6    # definition of object frames
7    - target-object-frame:
8      frame-mul:
9        - target-object-grasp # This has to be provided
10
11    - tool-frame:
12      frame-mul:
13        - right_ee_2
14        - tool-grasp # This has to be provided
15
16    # definition of features
17    - tool-point:
18      transform-vector: [tool-frame, {vector3: [0, 0, 0.025]}]
19    - target-object-point:
20      vector-add:
21        - transform-vector: [target-object-frame, {vector3: [0.02, object-width
22          -2, -0.02]}]
23        - {vector3: [0.0, 0.0, 0.0]} # 20 cm above the edge
24
25    # expressions used in constraints
26    - distance: {vector-sub: [target-object-point, tool-point]}
27
28    - r_2_goal_rot:
29      rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
30    - r_2_rot: {orientation-of: tool-frame}
31    - r_2_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
32      r_2_rot}, r_2_goal_rot]}}}
33    - r_2_rot_scaling:
34      double-if:
35        - {double-sub: [rot_thresh, r_2_rot_error]}
36        - 1
37        - {double-div: [rot_thresh, r_2_rot_error]}
38    - r_2_intermediate_goal_rot:
39      slerp:
40        - r_2_rot
41        - r_2_goal_rot
42        - r_2_rot_scaling
43    - r_2_rot_control:
44      scale-vector: [rot_p_gain, {rotate-vector: [r_2_rot, {rot-vector: {
45        rotation-mul: [{inverse-rotation: r_2_rot}, r_2_intermediate_goal_rot
46        ]}}]}]
47
48  soft-constraints:
49    - soft-constraint:
50      - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
51        boundary
52      - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
53        boundary
54      - constraint-weight # weight of this constraint
55      - {x-coord: distance} # expression used for Jacobian calculation

```

```

50     - contact_x # name of expression reported
51 - soft-constraint:
52     - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
      boundary
53     - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
      boundary
54     - constraint-weight # weight of this constraint
55     - {y-coord: distance} # expression used for Jacobian calculation
56     - contact_y # name of expression reported
57 - soft-constraint:
58     - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
      boundary
59     - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
      boundary
60     - constraint-weight # weight of this constraint
61     - {z-coord: distance} # expression used for Jacobian calculation
62     - contact_z # name of expression reported
63 - soft-constraint: [{x-coord: r_2_rot_control}, {x-coord: r_2_rot_control},
      weight_rot_control, {x-coord: {rot-vector: r_2_rot}}, right_2 EE x-rot
      control slack]
64 - soft-constraint: [{y-coord: r_2_rot_control}, {y-coord: r_2_rot_control},
      weight_rot_control, {y-coord: {rot-vector: r_2_rot}}, right_2 EE y-rot
      control slack]
65 - soft-constraint: [{z-coord: r_2_rot_control}, {z-coord: r_2_rot_control},
      weight_rot_control, {z-coord: {rot-vector: r_2_rot}}, right_2 EE z-rot
      control slack]

```

98 motions/tilting_{pull}.yaml

```

1 scope:
2   # weights
3   - controllable-weight: 0.001 # mu * 1
4   - constraint-weight: 10.001 # mu + 10
5
6   # definition of object frames
7   - target-object-frame:
8     frame-mul:
9     - target-object-grasp # This has to be provided
10
11   - tool-frame:
12     frame-mul:
13     - right_ee
14     - tool-grasp # This has to be provided
15   - tool-frame-2:
16     frame-mul:
17     - right_ee_2
18     - tool-grasp # This has to be provided
19
20   # definition of features
21   - tool-point:
22     transform-vector: [tool-frame, {vector3: [0, 0, 0.025]}]
23   - tool-point-2:
24     transform-vector: [tool-frame-2, {vector3: [0, 0, 0.025]}]
25   - target-object-point:
26     vector-add:
27     - transform-vector: [target-object-frame, {vector3: [0.6, 0.0, 0.6]}]
28     - {vector3: [0.0, 0.0, 0.0]} # 20 cm above the edge
29
30   # expressions used in constraints
31   - distance: {vector-sub: [target-object-point, tool-point]}
32   - distance-2: {vector-sub: [target-object-point, tool-point-2]}
33
34   - r_goal_rot:
35     rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
36   - r_rot: {orientation-of: tool-frame}
37   - r_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
38     r_rot}, r_goal_rot]}}}
39   - r_rot_scaling:
40     double-if:
41     - {double-sub: [rot_thresh, r_rot_error]}
42     - 1
43     - {double-div: [rot_thresh, r_rot_error]}
44   - r_intermediate_goal_rot:
45     slerp:
46     - r_rot
47     - r_goal_rot
48     - r_rot_scaling
49   - r_rot_control:
50     scale-vector: [rot_p_gain, {rotate-vector: [r_rot, {rot-vector: {rotation-
51     mul: [{inverse-rotation: r_rot}, r_intermediate_goal_rot]}}}]]
52   - r_2_goal_rot:
53     rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
54   - r_2_rot: {orientation-of: tool-frame-2}
55   - r_2_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:

```

```

        r_2_rot}, r_2_goal_rot]]}}
54 - r_2_rot_scaling:
55   double-if:
56   - {double-sub: [rot_thresh, r_2_rot_error]}
57   - 1
58   - {double-div: [rot_thresh, r_2_rot_error]}
59 - r_2_intermediate_goal_rot:
60   slerp:
61   - r_2_rot
62   - r_2_goal_rot
63   - r_2_rot_scaling
64 - r_2_rot_control:
65   scale-vector: [rot_p_gain, {rotate-vector: [r_2_rot, {rot-vector: {
        rotation-mul: [{inverse-rotation: r_2_rot}, r_2_intermediate_goal_rot
        ]}}]}]
66
67 soft-constraints:
68 - soft-constraint:
69   - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
        boundary
70   - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
        boundary
71   - constraint-weight # weight of this constraint
72   - {x-coord: distance} # expression used for Jacobian calculation
73   - contact_x # name of expression reported
74 - soft-constraint:
75   - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
        boundary
76   - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
        boundary
77   - constraint-weight # weight of this constraint
78   - {y-coord: distance} # expression used for Jacobian calculation
79   - contact_y # name of expression reported
80 - soft-constraint:
81   - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
        boundary
82   - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
        boundary
83   - constraint-weight # weight of this constraint
84   - {z-coord: distance} # expression used for Jacobian calculation
85   - contact_z # name of expression reported
86 - soft-constraint: [{x-coord: r_rot_control}, {x-coord: r_rot_control},
        weight_rot_control, {x-coord: {rot-vector: r_rot}}, right EE x-rot control
        slack]
87 - soft-constraint: [{y-coord: r_rot_control}, {y-coord: r_rot_control},
        weight_rot_control, {y-coord: {rot-vector: r_rot}}, right EE y-rot control
        slack]
88 - soft-constraint: [{z-coord: r_rot_control}, {z-coord: r_rot_control},
        weight_rot_control, {z-coord: {rot-vector: r_rot}}, right EE z-rot control
        slack]
89
90
91 - soft-constraint:
92   - {double-sub: [-0.007, {x-coord: distance-2}]} # control law for lower
        boundary
93   - {double-sub: [0.007, {x-coord: distance-2}]} # control law for upper
        boundary

```

```

94     - constraint-weight # weight of this constraint
95     - {x-coord: distance-2} # expression used for Jacobian calcuation
96     - contact_x # name of expression reported
97 - soft-constraint:
98     - {double-sub: [-0.007, {y-coord: distance-2}]} # control law for lower
      boundary
99     - {double-sub: [0.007, {y-coord: distance-2}]} # control law for upper
      boundary
100    - constraint-weight # weight of this constraint
101    - {y-coord: distance-2} # expression used for Jacobian calcuation
102    - contact_y # name of expression reported
103 - soft-constraint:
104    - {double-sub: [-0.007, {z-coord: distance-2}]} # control law for lower
      boundary
105    - {double-sub: [0.007, {z-coord: distance-2}]} # control law for upper
      boundary
106    - constraint-weight # weight of this constraint
107    - {z-coord: distance-2} # expression used for Jacobian calcuation
108    - contact_z # name of expression reported
109 - soft-constraint: [{x-coord: r_2_rot_control}, {x-coord: r_2_rot_control},
      weight_rot_control, {x-coord: {rot-vector: r_2_rot}}, right_2 EE x-rot
      control slack]
110 - soft-constraint: [{y-coord: r_2_rot_control}, {y-coord: r_2_rot_control},
      weight_rot_control, {y-coord: {rot-vector: r_2_rot}}, right_2 EE y-rot
      control slack]
111 - soft-constraint: [{z-coord: r_2_rot_control}, {z-coord: r_2_rot_control},
      weight_rot_control, {z-coord: {rot-vector: r_2_rot}}, right_2 EE z-rot
      control slack]

```

99 motions/tilting_{position}above.yaml

```

1  scope:
2    # weights
3    - controllable-weight: 0.001 # mu * 1
4    - constraint-weight: 10.001 # mu + 10
5
6    # definition of object frames
7    - target-object-frame:
8      frame-mul:
9        - target-object-grasp # This has to be provided
10
11    - tool-frame:
12      frame-mul:
13        - left_ee
14        - tool-grasp # This has to be provided
15
16    # definition of features
17    - tool-point:
18      transform-vector: [tool-frame, {vector3: [0, 0, 0.025]}]
19    - target-object-point:
20      vector-add:
21        - transform-vector: [target-object-frame, {vector3: [-0.05, 0, 0.1]}]
22        - {vector3: [0.0, 0.0, 0.0]} # 20 cm above the edge
23
24    # expressions used in constraints
25    - distance: {vector-sub: [target-object-point, tool-point]}
26
27    - l_goal_rot:
28      rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
29    - l_rot: {orientation-of: tool-frame}
30    - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
31      l_rot}, l_goal_rot]}}}
32    - l_rot_scaling:
33      double-if:
34        - {double-sub: [rot_thresh, l_rot_error]}
35        - 1
36        - {double-div: [rot_thresh, l_rot_error]}
37    - l_intermediate_goal_rot:
38      slerp:
39        - l_rot
40        - l_goal_rot
41        - l_rot_scaling
42    - l_rot_control:
43      scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
44      mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]}]
45
46  soft-constraints:
47    - soft-constraint:
48      - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
49        boundary
50      - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
51        boundary
52      - constraint-weight # weight of this constraint
53      - {x-coord: distance} # expression used for Jacobian calculation
54      - contact_x # name of expression reported
55    - soft-constraint:

```

```

52     - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
        boundary
53     - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
        boundary
54     - constraint-weight # weight of this constraint
55     - {y-coord: distance} # expression used for Jacobian calculation
56     - contact_y # name of expression reported
57 - soft-constraint:
58     - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
        boundary
59     - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
        boundary
60     - constraint-weight # weight of this constraint
61     - {z-coord: distance} # expression used for Jacobian calculation
62     - contact_z # name of expression reported
63 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
        weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
        slack]
64 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
        weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
        slack]
65 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
        weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
        slack]

```


100 motions/tilting_{touch}_{op}.yaml

```

1  scope:
2    # weights
3    - controllable-weight: 0.001 # mu * 1
4    - constraint-weight: 10.001 # mu + 10
5
6    # definition of object frames
7    - target-object-frame:
8      frame-mul:
9        - target-object-grasp # This has to be provided
10
11    - tool-frame:
12      frame-mul:
13        - left_ee
14        - tool-grasp # This has to be provided
15
16    # definition of features
17    - tool-point:
18      transform-vector: [tool-frame, {vector3: [0, 0, 0.025]}]
19    - target-object-point:
20      vector-add:
21        - transform-vector: [target-object-frame, {vector3: [-0.05, 0, 0.0]}]
22        - {vector3: [0.0, 0, 0.0]} # 0 cm beneath the edge
23
24    # expressions used in constraints
25    - distance: {vector-sub: [target-object-point, tool-point]}
26
27    - l_goal_rot:
28      rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
29    - l_rot: {orientation-of: tool-frame}
30    - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
31      l_rot}, l_goal_rot]}}}
32    - l_rot_scaling:
33      double-if:
34        - {double-sub: [rot_thresh, l_rot_error]}
35        - 1
36        - {double-div: [rot_thresh, l_rot_error]}
37    - l_intermediate_goal_rot:
38      slerp:
39        - l_rot
40        - l_goal_rot
41        - l_rot_scaling
42    - l_rot_control:
43      scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
44      mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
45
46  soft-constraints:
47    - soft-constraint:
48      - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
49        boundary
50      - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
51        boundary
52      - constraint-weight # weight of this constraint
53      - {x-coord: distance} # expression used for Jacobian calculation
54      - contact_x # name of expression reported
55    - soft-constraint:

```

```

52     - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
        boundary
53     - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
        boundary
54     - constraint-weight # weight of this constraint
55     - {y-coord: distance} # expression used for Jacobian calculation
56     - contact_y # name of expression reported
57 - soft-constraint:
58     - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
        boundary
59     - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
        boundary
60     - constraint-weight # weight of this constraint
61     - {z-coord: distance} # expression used for Jacobian calculation
62     - contact_z # name of expression reported
63 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
        weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
        slack]
64 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
        weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
        slack]
65 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
        weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
        slack]

```

101 motions/scraping_{position}_{above}.yaml

```

1 scope:
2   # weights
3   - controllable-weight: 0.001 # mu * 1
4   - constraint-weight: 10.001 # mu + 10
5
6   # definition of object frames
7   - target-object-frame:
8     frame-mul:
9     - right_ee
10    - target-object-grasp # This has to be provided
11
12   - tool-frame:
13     frame-mul:
14     - left_ee
15     - tool-grasp # This has to be provided
16
17   # definition of features
18   - tool-point:
19     transform-vector: [tool-frame, tool-heel]
20   - target-object-point:
21     vector-add:
22     - transform-vector: [target-object-frame, edge-point]
23     - {vector3: [0, 0, 0.2]} # 20 cm above the edge
24
25   # expressions used in constraints
26   - distance: {vector-sub: [target-object-point, tool-point]}
27
28   - l_goal_rot:
29     rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
30   - l_rot: {orientation-of: tool-frame}
31   - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
32     l_rot}, l_goal_rot]}}}
33   - l_rot_scaling:
34     double-if:
35     - {double-sub: [rot_thresh, l_rot_error]}
36     - 1
37     - {double-div: [rot_thresh, l_rot_error]}
38   - l_intermediate_goal_rot:
39     slerp:
40     - l_rot
41     - l_goal_rot
42     - l_rot_scaling
43   - l_rot_control:
44     scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
45     mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
46
47 soft-constraints:
48   - soft-constraint:
49     - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
50     boundary
51     - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
52     boundary
53   - constraint-weight # weight of this constraint
54   - {x-coord: distance} # expression used for Jacobian calcuation
55   - contact_x # name of expression reported

```

```

52 - soft-constraint:
53   - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
      boundary
54   - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
      boundary
55   - constraint-weight # weight of this constraint
56   - {y-coord: distance} # expression used for Jacobian calculation
57   - contact_y # name of expression reported
58 - soft-constraint:
59   - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
      boundary
60   - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
      boundary
61   - constraint-weight # weight of this constraint
62   - {z-coord: distance} # expression used for Jacobian calculation
63   - contact_z # name of expression reported
64 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
      weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
      slack]
65 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
      weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
      slack]
66 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
      weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
      slack]

```

102 motions/tilting_grab.yaml

```

1 scope:
2   # weights
3   - controllable-weight: 0.001 # mu * 1
4   - constraint-weight: 10.001 # mu + 10
5
6   # definition of object frames
7   - target-object-frame:
8     frame-mul:
9     - target-object-grasp # This has to be provided
10
11   - tool-frame:
12     frame-mul:
13     - right_ee
14     - tool-grasp # This has to be provided
15   - tool-frame-2:
16     frame-mul:
17     - right_ee_2
18     - tool-grasp # This has to be provided
19
20   # definition of features
21   - tool-point:
22     transform-vector: [tool-frame, {vector3: [0, 0, 0.025]}]
23   - tool-point-2:
24     transform-vector: [tool-frame-2, {vector3: [0, 0, 0.025]}]
25   - target-object-point:
26     vector-add:
27     - transform-vector: [target-object-frame, {vector3: [0.02, 0.00,
28       -0.02]}]
29     - {vector3: [0.0, 0.0, 0.0]} # 20 cm above the edge
30
31   # expressions used in constraints
32   - distance: {vector-sub: [target-object-point, tool-point]}
33   - distance-2: {vector-sub: [target-object-point, tool-point-2]}
34
35   - r_goal_rot:
36     rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
37   - r_rot: {orientation-of: tool-frame}
38   - r_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
39     r_rot}, r_goal_rot]}}}
40   - r_rot_scaling:
41     double-if:
42     - {double-sub: [rot_thresh, r_rot_error]}
43     - 1
44     - {double-div: [rot_thresh, r_rot_error]}
45   - r_intermediate_goal_rot:
46     slerp:
47     - r_rot
48     - r_goal_rot
49     - r_rot_scaling
50   - r_rot_control:
51     scale-vector: [rot_p_gain, {rotate-vector: [r_rot, {rot-vector: {rotation-
52     mul: [{inverse-rotation: r_rot}, r_intermediate_goal_rot]}}}]]
53   - r_2_goal_rot:
54     rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
55   - r_2_rot: {orientation-of: tool-frame-2}

```

```

53 - r_2_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
54   r_2_rot}, r_2_goal_rot]}}}
55 - r_2_rot_scaling:
56   double-if:
57     - {double-sub: [rot_thresh, r_2_rot_error]}
58     - 1
59     - {double-div: [rot_thresh, r_2_rot_error]}
60 - r_2_intermediate_goal_rot:
61   slerp:
62     - r_2_rot
63     - r_2_goal_rot
64     - r_2_rot_scaling
65 - r_2_rot_control:
66   scale-vector: [rot_p_gain, {rotate-vector: [r_2_rot, {rot-vector: {
67     rotation-mul: [{inverse-rotation: r_2_rot}, r_2_intermediate_goal_rot
68     ]}}}]]
69
70 soft-constraints:
71 - soft-constraint:
72   - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
73     boundary
74   - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
75     boundary
76   - constraint-weight # weight of this constraint
77   - {x-coord: distance} # expression used for Jacobian calculation
78   - contact_x # name of expression reported
79 - soft-constraint:
80   - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
81     boundary
82   - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
83     boundary
84   - constraint-weight # weight of this constraint
85   - {y-coord: distance} # expression used for Jacobian calculation
86   - contact_y # name of expression reported
87 - soft-constraint:
88   - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
89     boundary
90   - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
91     boundary
92   - constraint-weight # weight of this constraint
93   - {z-coord: distance} # expression used for Jacobian calculation
94   - contact_z # name of expression reported
95 - soft-constraint: [{x-coord: r_rot_control}, {x-coord: r_rot_control},
96   weight_rot_control, {x-coord: {rot-vector: r_rot}}, right EE x-rot control
97   slack]
98 - soft-constraint: [{y-coord: r_rot_control}, {y-coord: r_rot_control},
99   weight_rot_control, {y-coord: {rot-vector: r_rot}}, right EE y-rot control
100  slack]
101 - soft-constraint: [{z-coord: r_rot_control}, {z-coord: r_rot_control},
102   weight_rot_control, {z-coord: {rot-vector: r_rot}}, right EE z-rot control
103   slack]
104
105 - soft-constraint:
106   - {double-sub: [-0.007, {x-coord: distance-2}]} # control law for lower
107     boundary
108   - {double-sub: [0.007, {x-coord: distance-2}]} # control law for upper

```

```

    boundary
94     - constraint-weight # weight of this constraint
95     - {x-coord: distance-2} # expression used for Jacobian calcuation
96     - contact_x # name of expression reported
97 - soft-constraint:
98     - {double-sub: [-0.007, {y-coord: distance-2}]} # control law for lower
    boundary
99     - {double-sub: [0.007, {y-coord: distance-2}]} # control law for upper
    boundary
100    - constraint-weight # weight of this constraint
101    - {y-coord: distance-2} # expression used for Jacobian calcuation
102    - contact_y # name of expression reported
103 - soft-constraint:
104    - {double-sub: [-0.007, {z-coord: distance-2}]} # control law for lower
    boundary
105    - {double-sub: [0.007, {z-coord: distance-2}]} # control law for upper
    boundary
106    - constraint-weight # weight of this constraint
107    - {z-coord: distance-2} # expression used for Jacobian calcuation
108    - contact_z # name of expression reported
109 - soft-constraint: [{x-coord: r_2_rot_control}, {x-coord: r_2_rot_control},
    weight_rot_control, {x-coord: {rot-vector: r_2_rot}}, right_2 EE x-rot
    control slack]
110 - soft-constraint: [{y-coord: r_2_rot_control}, {y-coord: r_2_rot_control},
    weight_rot_control, {y-coord: {rot-vector: r_2_rot}}, right_2 EE y-rot
    control slack]
111 - soft-constraint: [{z-coord: r_2_rot_control}, {z-coord: r_2_rot_control},
    weight_rot_control, {z-coord: {rot-vector: r_2_rot}}, right_2 EE z-rot
    control slack]

```

103 motions/tilting_{position}front.yaml

```

1 scope:
2   # weights
3   - controllable-weight: 0.001 # mu * 1
4   - constraint-weight: 10.001 # mu + 10
5
6   # definition of object frames
7   - target-object-frame:
8     frame-mul:
9     - target-object-grasp # This has to be provided
10
11   - tool-frame:
12     frame-mul:
13     - right_ee
14     - tool-grasp # This has to be provided
15
16   # definition of features
17   - tool-point:
18     transform-vector: [tool-frame, {vector3: [0, 0, 0.025]}]
19   - target-object-point:
20     vector-add:
21     - transform-vector: [target-object-frame, {vector3: [0.02, object-width,
22       -0.02]}]
23     - {vector3: [0.0, 0.0, 0.0]} # 20 cm above the edge
24
25   # expressions used in constraints
26   - distance: {vector-sub: [target-object-point, tool-point]}
27
28   - r_goal_rot:
29     rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
30   - r_rot: {orientation-of: tool-frame}
31   - r_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
32     r_rot}, r_goal_rot]}}}
33   - r_rot_scaling:
34     double-if:
35     - {double-sub: [rot_thresh, r_rot_error]}
36     - 1
37     - {double-div: [rot_thresh, r_rot_error]}
38   - r_intermediate_goal_rot:
39     slerp:
40     - r_rot
41     - r_goal_rot
42     - r_rot_scaling
43   - r_rot_control:
44     scale-vector: [rot_p_gain, {rotate-vector: [r_rot, {rot-vector: {rotation-
45     mul: [{inverse-rotation: r_rot}, r_intermediate_goal_rot]}}}]]
46
47 soft-constraints:
48   - soft-constraint:
49     - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
50     boundary
51     - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
52     boundary
53     - constraint-weight # weight of this constraint
54     - {x-coord: distance} # expression used for Jacobian calculation
55     - contact_x # name of expression reported

```



```

51 - soft-constraint:
52   - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
      boundary
53   - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
      boundary
54   - constraint-weight # weight of this constraint
55   - {y-coord: distance} # expression used for Jacobian calculation
56   - contact_y # name of expression reported
57 - soft-constraint:
58   - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
      boundary
59   - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
      boundary
60   - constraint-weight # weight of this constraint
61   - {z-coord: distance} # expression used for Jacobian calculation
62   - contact_z # name of expression reported
63 - soft-constraint: [{x-coord: r_rot_control}, {x-coord: r_rot_control},
      weight_rot_control, {x-coord: {rot-vector: r_rot}}, right EE x-rot control
      slack]
64 - soft-constraint: [{y-coord: r_rot_control}, {y-coord: r_rot_control},
      weight_rot_control, {y-coord: {rot-vector: r_rot}}, right EE y-rot control
      slack]
65 - soft-constraint: [{z-coord: r_rot_control}, {z-coord: r_rot_control},
      weight_rot_control, {z-coord: {rot-vector: r_rot}}, right EE z-rot control
      slack]

```

104 motions/cutting_{cut}.yaml

```

1 scope:
2   # weights
3   - controllable-weight: 0.001 # mu * 1
4   - constraint-weight: 10.001 # mu + 10
5
6   # definition of object frames
7   - target-object-frame:
8     frame:
9     - quaternion: [0, 0, 0, 1]
10    - vector3: [0, 0, 1.03]
11
12   - tool-frame:
13     frame-mul:
14     - left_ee
15     - tool-grasp # This has to be provided
16
17   # definition of features
18   - tool-point:
19     transform-vector: [tool-frame, blade-point]
20   - target-object-point:
21     transform-vector:
22     - target-object-frame
23     - {vector3: [0, 0, -0.01]} # 0 cm above the object
24
25   # expressions used in constraints
26   - distance: {vector-sub: [target-object-point, tool-point]}
27
28   - l_goal_rot:
29     rotation-mul:
30     - {axis-angle: [unit-z, 3.14]}
31     - {axis-angle: [unit-y, 0]}
32     - {axis-angle: [unit-x, 1.57]}
33   - l_rot: {orientation-of: tool-frame}
34   - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
35     l_rot}, l_goal_rot]}}}
36   - l_rot_scaling:
37     double-if:
38     - {double-sub: [rot_thresh, l_rot_error]}
39     - 1
40     - {double-div: [rot_thresh, l_rot_error]}
41   - l_intermediate_goal_rot:
42     slerp:
43     - l_rot
44     - l_goal_rot
45     - l_rot_scaling
46   - l_rot_control:
47     scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
48     mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
49
50 soft-constraints:
51   - soft-constraint:
52     - {double-sub: [-0.005, {x-coord: distance}]} # control law for lower
53     boundary
54     - {double-sub: [0.005, {x-coord: distance}]} # control law for upper
55     boundary

```

```

52     - constraint-weight # weight of this constraint
53     - {x-coord: distance} # expression used for Jacobian calcuation
54     - contact_x # name of expression reported
55 - soft-constraint:
56     - {double-sub: [-0.005, {y-coord: distance}]} # control law for lower
        boundary
57     - {double-sub: [0.005, {y-coord: distance}]} # control law for upper
        boundary
58     - constraint-weight # weight of this constraint
59     - {y-coord: distance} # expression used for Jacobian calcuation
60     - contact_y # name of expression reported
61 - soft-constraint:
62     - {double-sub: [-0.005, {z-coord: distance}]} # control law for lower
        boundary
63     - {double-sub: [0.005, {z-coord: distance}]} # control law for upper
        boundary
64     - constraint-weight # weight of this constraint
65     - {z-coord: distance} # expression used for Jacobian calcuation
66     - contact_z # name of expression reported
67 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
        weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
        slack]
68 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
        weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
        slack]
69 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
        weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
        slack]

```

105 motions/scooping_{scoop}.yaml

```

1  scope:
2    # weights
3    - controllable-weight: 0.001 # mu * 1
4    - constraint-weight: 10.001 # mu + 10
5
6    # definition of object frames
7    - target-object-frame:
8      frame-mul:
9        - right_ee
10       - tool-grasp # This has to be provided
11
12    - tool-frame:
13      frame-mul:
14        - left_ee
15        - target-object-grasp # This has to be provided
16
17    # definition of features
18    - tool-point:
19      transform-vector: [tool-frame, {vector3: [-0.1149, -0.005, -0.0118]}]
20    - target-object-point:
21      transform-vector: [target-object-frame, {vector3: [0.018, -0.04, 0.0]}]
22
23    # expressions used in constraints
24    - distance: {vector-sub: [target-object-point, tool-point]}
25
26    - l_goal_rot:
27      rotation-mul:
28        - {axis-angle: [unit-z, 1.57]}
29        - {axis-angle: [unit-y, -0.3]}
30        - {axis-angle: [unit-x, 3.14]}
31    - l_rot: {orientation-of: tool-frame}
32    - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
33      l_rot}, l_goal_rot]}}}
34    - l_rot_scaling:
35      double-if:
36        - {double-sub: [rot_thresh, l_rot_error]}
37        - 1
38        - {double-div: [rot_thresh, l_rot_error]}
39    - l_intermediate_goal_rot:
40      slerp:
41        - l_rot
42        - l_goal_rot
43        - l_rot_scaling
44    - l_rot_control:
45      scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
46        mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
47
48  soft-constraints:
49    - soft-constraint:
50      - {double-sub: [-0.005, {x-coord: distance}]} # control law for lower
51        boundary
52      - {double-sub: [0.005, {x-coord: distance}]} # control law for upper
53        boundary
54      - constraint-weight # weight of this constraint
55      - {x-coord: distance} # expression used for Jacobian calculation

```

```

52     - contact_x # name of expression reported
53 - soft-constraint:
54     - {double-sub: [-0.005, {y-coord: distance}]} # control law for lower
      boundary
55     - {double-sub: [0.005, {y-coord: distance}]} # control law for upper
      boundary
56     - constraint-weight # weight of this constraint
57     - {y-coord: distance} # expression used for Jacobian calculation
58     - contact_y # name of expression reported
59 - soft-constraint:
60     - {double-sub: [-0.005, {z-coord: distance}]} # control law for lower
      boundary
61     - {double-sub: [0.005, {z-coord: distance}]} # control law for upper
      boundary
62     - constraint-weight # weight of this constraint
63     - {z-coord: distance} # expression used for Jacobian calculation
64     - contact_z # name of expression reported
65 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
      weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
      slack]
66 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
      weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
      slack]
67 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
      weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
      slack]

```

106 motions/scooping_{position}_{above}.yaml

```

1  scope:
2    # weights
3    - controllable-weight: 0.001 # mu * 1
4    - constraint-weight: 10.001 # mu + 10
5
6    # definition of object frames
7    - target-object-frame:
8      frame-mul:
9        - right_ee
10       - target-object-grasp # This has to be provided
11
12    - tool-frame:
13      frame-mul:
14        - left_ee
15        - tool-grasp # This has to be provided
16
17    # definition of features
18    - tool-point:
19      transform-vector: [tool-frame, {vector3: [-0.1149, -0.005, -0.0118]}]
20    - target-object-point:
21      transform-vector: [target-object-frame, {vector3: [0.018, 0.02, 0.245]}]
22
23    # expressions used in constraints
24    - distance: {vector-sub: [target-object-point, tool-point]}
25
26    - l_goal_rot:
27      rotation-mul:
28        - {axis-angle: [unit-z, 0]}
29        - {axis-angle: [unit-y, -1.57]}
30        - {axis-angle: [unit-x, -1.57]}
31    - l_rot: {orientation-of: tool-frame}
32    - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
33      l_rot}, l_goal_rot]}}}
34    - l_rot_scaling:
35      double-if:
36        - {double-sub: [rot_thresh, l_rot_error]}
37        - 1
38        - {double-div: [rot_thresh, l_rot_error]}
39    - l_intermediate_goal_rot:
40      slerp:
41        - l_rot
42        - l_goal_rot
43        - l_rot_scaling
44    - l_rot_control:
45      scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
46        mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
47
48  soft-constraints:
49    - soft-constraint:
50      - {double-sub: [-0.005, {x-coord: distance}]} # control law for lower
51        boundary
52      - {double-sub: [0.005, {x-coord: distance}]} # control law for upper
53        boundary
54      - constraint-weight # weight of this constraint
55      - {x-coord: distance} # expression used for Jacobian calculation

```

```

52     - contact_x # name of expression reported
53 - soft-constraint:
54     - {double-sub: [-0.005, {y-coord: distance}]} # control law for lower
      boundary
55     - {double-sub: [0.005, {y-coord: distance}]} # control law for upper
      boundary
56     - constraint-weight # weight of this constraint
57     - {y-coord: distance} # expression used for Jacobian calculation
58     - contact_y # name of expression reported
59 - soft-constraint:
60     - {double-sub: [-0.005, {z-coord: distance}]} # control law for lower
      boundary
61     - {double-sub: [0.005, {z-coord: distance}]} # control law for upper
      boundary
62     - constraint-weight # weight of this constraint
63     - {z-coord: distance} # expression used for Jacobian calculation
64     - contact_z # name of expression reported
65 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
      weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
      slack]
66 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
      weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
      slack]
67 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
      weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
      slack]

```

107 motions/scooping_{ift}.yaml

```

1 scope:
2   # weights
3   - controllable-weight: 0.001 # mu * 1
4   - constraint-weight: 10.001 # mu + 10
5
6   # definition of object frames
7   - target-object-frame:
8     frame-mul:
9     - right_ee
10    - tool-grasp # This has to be provided
11
12   - tool-frame:
13     frame-mul:
14     - left_ee
15     - target-object-grasp # This has to be provided
16
17   # definition of features
18   - tool-point:
19     transform-vector: [tool-frame, {vector3: [-0.1149, -0.005, -0.0118]}]
20   - target-object-point:
21     transform-vector: [target-object-frame, {vector3: [0.018, -0.04, 0.245]}]
22
23   # expressions used in constraints
24   - distance: {vector-sub: [target-object-point, tool-point]}
25
26   - l_goal_rot:
27     rotation-mul:
28     - {axis-angle: [unit-z, 1.57]}
29     - {axis-angle: [unit-y, -0.3]}
30     - {axis-angle: [unit-x, 3.14]}
31   - l_rot: {orientation-of: tool-frame}
32   - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
33     l_rot}, l_goal_rot]}}}
34   - l_rot_scaling:
35     double-if:
36     - {double-sub: [rot_thresh, l_rot_error]}
37     - 1
38     - {double-div: [rot_thresh, l_rot_error]}
39   - l_intermediate_goal_rot:
40     slerp:
41     - l_rot
42     - l_goal_rot
43     - l_rot_scaling
44   - l_rot_control:
45     scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
46     mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
47
48 soft-constraints:
49   - soft-constraint:
50     - {double-sub: [-0.005, {x-coord: distance}]} # control law for lower
51       boundary
52     - {double-sub: [0.005, {x-coord: distance}]} # control law for upper
53       boundary
54     - constraint-weight # weight of this constraint
55     - {x-coord: distance} # expression used for Jacobian calculation

```



```

52     - contact_x # name of expression reported
53 - soft-constraint:
54     - {double-sub: [-0.005, {y-coord: distance}]} # control law for lower
      boundary
55     - {double-sub: [0.005, {y-coord: distance}]} # control law for upper
      boundary
56     - constraint-weight # weight of this constraint
57     - {y-coord: distance} # expression used for Jacobian calculation
58     - contact_y # name of expression reported
59 - soft-constraint:
60     - {double-sub: [-0.005, {z-coord: distance}]} # control law for lower
      boundary
61     - {double-sub: [0.005, {z-coord: distance}]} # control law for upper
      boundary
62     - constraint-weight # weight of this constraint
63     - {z-coord: distance} # expression used for Jacobian calculation
64     - contact_z # name of expression reported
65 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
      weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
      slack]
66 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
      weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
      slack]
67 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
      weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
      slack]

```

108 motions/cutting_{position}_{above}.yaml

```

1 scope:
2   # weights
3   - controllable-weight: 0.001 # mu * 1
4   - constraint-weight: 10.001 # mu + 10
5
6   # definition of object frames
7   - target-object-frame:
8     frame:
9     - quaternion: [0, 0, 0, 1]
10    - vector3: [0, 0, 1.03]
11
12   - tool-frame:
13     frame-mul:
14     - left_ee
15     - tool-grasp # This has to be provided
16
17   # definition of features
18   - tool-point:
19     transform-vector: [tool-frame, blade-point]
20   - target-object-point:
21     transform-vector:
22     - target-object-frame
23     - {vector3: [0, 0, 0.3]} # 20 cm above the object
24
25   # expressions used in constraints
26   - distance: {vector-sub: [target-object-point, tool-point]}
27
28   - l_goal_rot:
29     rotation-mul:
30     - {axis-angle: [unit-z, 3.14]}
31     - {axis-angle: [unit-y, 0]}
32     - {axis-angle: [unit-x, 1.57]}
33   - l_rot: {orientation-of: tool-frame}
34   - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
35     l_rot}, l_goal_rot]}}}
36   - l_rot_scaling:
37     double-if:
38     - {double-sub: [rot_thresh, l_rot_error]}
39     - 1
40     - {double-div: [rot_thresh, l_rot_error]}
41   - l_intermediate_goal_rot:
42     slerp:
43     - l_rot
44     - l_goal_rot
45     - l_rot_scaling
46   - l_rot_control:
47     scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
48     mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
49
50 soft-constraints:
51   - soft-constraint:
52     - {double-sub: [-0.005, {x-coord: distance}]} # control law for lower
53     boundary
54     - {double-sub: [0.005, {x-coord: distance}]} # control law for upper
55     boundary

```

```

52     - constraint-weight # weight of this constraint
53     - {x-coord: distance} # expression used for Jacobian calculation
54     - contact_x # name of expression reported
55 - soft-constraint:
56     - {double-sub: [-0.005, {y-coord: distance}]} # control law for lower
        boundary
57     - {double-sub: [0.005, {y-coord: distance}]} # control law for upper
        boundary
58     - constraint-weight # weight of this constraint
59     - {y-coord: distance} # expression used for Jacobian calculation
60     - contact_y # name of expression reported
61 - soft-constraint:
62     - {double-sub: [-0.005, {z-coord: distance}]} # control law for lower
        boundary
63     - {double-sub: [0.005, {z-coord: distance}]} # control law for upper
        boundary
64     - constraint-weight # weight of this constraint
65     - {z-coord: distance} # expression used for Jacobian calculation
66     - contact_z # name of expression reported
67 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
    weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
    slack]
68 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
    weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
    slack]
69 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
    weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
    slack]

```

109 motions/scraping_scrape_off.yaml

```

1 scope:
2   # weights
3   - controllable-weight: 0.001 # mu * 1
4   - constraint-weight: 10.001 # mu + 10
5
6   # definition of object frames
7   - target-object-frame:
8     frame-mul:
9     - right_ee
10    - target-object-grasp # This has to be provided
11
12   - tool-frame:
13     frame-mul:
14     - left_ee
15     - tool-grasp # This has to be provided
16
17   # definition of features
18   - tool-point:
19     transform-vector: [tool-frame, tool-heel]
20   - target-object-point:
21     vector-add:
22     - transform-vector: [target-object-frame, edge-point]
23     - {vector3: [0, 0.3, 0]} # 30 cm next to the edge
24
25   # expressions used in constraints
26   - distance: {vector-sub: [target-object-point, tool-point]}
27
28   - l_goal_rot:
29     rotation-mul: [tool-quaternion, {orientation-of: target-object-frame}]
30   - l_rot: {orientation-of: tool-frame}
31   - l_rot_error: {vector-norm: {rot-vector: {rotation-mul: [{inverse-rotation:
32     l_rot}, l_goal_rot]}}}
33   - l_rot_scaling:
34     double-if:
35     - {double-sub: [rot_thresh, l_rot_error]}
36     - 1
37     - {double-div: [rot_thresh, l_rot_error]}
38   - l_intermediate_goal_rot:
39     slerp:
40     - l_rot
41     - l_goal_rot
42     - l_rot_scaling
43   - l_rot_control:
44     scale-vector: [rot_p_gain, {rotate-vector: [l_rot, {rot-vector: {rotation-
45     mul: [{inverse-rotation: l_rot}, l_intermediate_goal_rot]}}}]]
46
47 soft-constraints:
48   - soft-constraint:
49     - {double-sub: [-0.007, {x-coord: distance}]} # control law for lower
50     boundary
51     - {double-sub: [0.007, {x-coord: distance}]} # control law for upper
52     boundary
53   - constraint-weight # weight of this constraint
54   - {x-coord: distance} # expression used for Jacobian calculation
55   - contact_x # name of expression reported

```

```

52 - soft-constraint:
53   - {double-sub: [-0.007, {y-coord: distance}]} # control law for lower
      boundary
54   - {double-sub: [0.007, {y-coord: distance}]} # control law for upper
      boundary
55   - constraint-weight # weight of this constraint
56   - {y-coord: distance} # expression used for Jacobian calculation
57   - contact_y # name of expression reported
58 - soft-constraint:
59   - {double-sub: [-0.007, {z-coord: distance}]} # control law for lower
      boundary
60   - {double-sub: [0.007, {z-coord: distance}]} # control law for upper
      boundary
61   - constraint-weight # weight of this constraint
62   - {z-coord: distance} # expression used for Jacobian calculation
63   - contact_z # name of expression reported
64 - soft-constraint: [{x-coord: l_rot_control}, {x-coord: l_rot_control},
      weight_rot_control, {x-coord: {rot-vector: l_rot}}, left EE x-rot control
      slack]
65 - soft-constraint: [{y-coord: l_rot_control}, {y-coord: l_rot_control},
      weight_rot_control, {y-coord: {rot-vector: l_rot}}, left EE y-rot control
      slack]
66 - soft-constraint: [{z-coord: l_rot_control}, {z-coord: l_rot_control},
      weight_rot_control, {z-coord: {rot-vector: l_rot}}, left EE z-rot control
      slack]

```

110 utilities/*aply2dae.mlx*

```
1 <!DOCTYPE FilterScript>
2 <FilterScript>
3   <filter name="QuadricEdgeCollapseDecimation">
4     <Param type="RichInt" value="3000" name="TargetFaceNum"/>
5     <Param type="RichFloat" value="0" name="TargetPerc"/>
6     <Param type="RichFloat" value="0.3" name="QualityThr"/>
7     <Param type="RichBool" value="false" name="PreserveBoundary"/>
8     <Param type="RichFloat" value="1" name="BoundaryWeight"/>
9     <Param type="RichBool" value="false" name="PreserveNormal"/>
10    <Param type="RichBool" value="false" name="PreserveTopology"/>
11    <Param type="RichBool" value="true" name="OptimalPlacement"/>
12    <Param type="RichBool" value="false" name="PlanarQuadric"/>
13    <Param type="RichBool" value="false" name="QualityWeight"/>
14    <Param type="RichBool" value="true" name="AutoClean"/>
15    <Param type="RichBool" value="false" name="Selected"/>
16  </filter>
17  <filter name="SurfaceReconstruction:BallPivoting">
18    <Param type="RichAbsPerc" value="0" min="0" name="BallRadius" max="0.296284"/>
19    <Param type="RichFloat" value="20" name="Clustering"/>
20    <Param type="RichFloat" value="90" name="CreaseThr"/>
21    <Param type="RichBool" value="false" name="DeleteFaces"/>
22  </filter>
23 </FilterScript>
```

111 msg/StopCondition.msg

```
1 float64 measured_velocity_min
2 float64 desired_velocity_min
3 bool contact
4 float64 activation_distance
```

112 src2pdf.sh

```
1  #!/usr/bin/env bash
2
3  tex_file=$(mktemp) ## Random temp file name
4
5  cat<<EOF >$tex_file ## Print the tex file header
6  \documentclass{article}
7  \usepackage{listings}
8  \usepackage[usenames,dvipsnames]{color} %% Allow color names
9  \lstdefinestyle{customasm}{
10     belowcaptionskip=1\baselineskip,
11     xleftmargin=\parindent,
12     language=C++, %% Change this to whatever you write in
13     breaklines=true, %% Wrap long lines
14     numbers=left,
15     basicstyle=\footnotesize\ttfamily,
16     commentstyle=\itshape\color{Gray},
17     stringstyle=\color{Black},
18     keywordstyle=\bfseries\color{OliveGreen},
19     identifierstyle=\color{blue},
20     xleftmargin=-8em,
21 }
22 \usepackage[colorlinks=true,linkcolor=blue]{hyperref}
23 \begin{document}
24 \tableofcontents
25
26 EOF
27
28 find . -type f ! -regex ".*\/\..*" ! -name ".*" ! -name "*~" ! -name 'src2pdf' !
    -name "*.ply" ! -name "*.dae" ! -name "*.stl" ! -name "*.png" ! -name "*.mkv"
    ! -name "*.mat"|
29 sed 's/^\.\.\/' | ## Change ./foo/bar.src to foo/bar.src
30
31 while read i; do ## Loop through each file
32     name=${i//_/\_} ## escape underscores
33     echo "\newpage" >> $tex_file ## start each section on a new page
34     echo "\section{$i}" >> $tex_file ## Create a section for each filename
35
36     ## This command will include the file in the PDF
37     echo "\lstinputlisting[style=customasm]{$i}" >>$tex_file
38 done &&
39 echo "\end{document}" >> $tex_file &&
40 pdflatex $tex_file -output-directory . &&
41 pdflatex $tex_file -output-directory . ## This needs to be run twice
42                                     ## for the TOC to be generated
```


113 models/b_{red}_{bowl}/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='b_red_bowl'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.4</mass>
10                 <pose>8.6337e-05 -2.0434e-06 0.00068192 0 0 0</pose>
11                 <inertia>
12                     <ixx>1.8603e-07</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>1.8901e-07</iyy>
16                     <iyz>0</iyz>
17                     <izz>3.0046e-09</izz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <mesh>
23                         <uri>model://b_red_bowl/
24                             b_red_bowl.dae</uri>
25                     </mesh>
26                 </geometry>
27                 <surface>
28                     <friction>
29                         <ode>
30                             <mu>0.2</mu>
31                             <mu2>0.2</mu2>
32                         </ode>
33                     </friction>
34                 </surface>
35             </collision>
36             <visual name='visual'>
37                 <geometry>
38                     <mesh>
39                         <uri>model://b_red_bowl/
40                             b_red_bowl.dae</uri>
41                     </mesh>
42                 </geometry>
43             </visual>
44         </link>
45     </model>
46 </sdf>

```

114 models/b_{red}_{bowl}/model.config

```
1 <?xml version="1.0"?>
2
3 <model>
4   <name>b_red_bowl</name>
5   <version>1.0</version>
6   <sdf version="1.6">model.sdf</sdf>
7
8   <author>
9     <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10    <email>bryanwang1992@outlook.com</email>
11  </author>
12
13  <description>
14    b_red_bowl
15  </description>
16
17 </model>
```

115 models/butter_{box}/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='butter_box'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6          <link name='link'>
7              <pose>0 0 0 0 0 0</pose>
8              <inertial>
9                  <mass>0.001</mass>
10                 <pose>0 0 0 0 0 0</pose>
11                 <inertia>
12                     <ixx>0.00000004167</ixx>
13                     <iyy>0.00000008333</iyy>
14                     <izz>0.00000010833</izz>
15                     <ixy>0</ixy>
16                     <ixz>0</ixz>
17                     <iyz>0</iyz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <box>
23                         <size>0.03 0.02 0.01</size>
24                     </box>
25                 </geometry>
26                 <surface>
27                     <friction>
28                         <ode>
29                             <mu>0.2</mu>
30                             <mu2>0.2</mu2>
31                         </ode>
32                     </friction>
33                 </surface>
34             </collision>
35             <visual name='visual'>
36                 <geometry>
37                     <box>
38                         <size>0.03 0.02 0.01</size>
39                     </box>
40                 </geometry>
41                 <material>
42                     <script>
43                         <name>Gazebo/Yellow</name>
44                         <uri>file://media/materials/scripts/gazebo.material</uri>
45                     </script>
46                 </material>
47             </visual>
48         </link>
49     </model>
50 </sdf>

```

116 models/butter_{box}/model.config

```
1  <?xml version='1.0'?>
2
3  <model>
4    <name>butter_box</name>
5    <version>1.0</version>
6    <sdf version='1.6'>model.sdf</sdf>
7
8    <author>
9      <name>me</name>
10     <email>somebody@somewhere.com</email>
11   </author>
12
13   <description>
14     A simple box butter.
15   </description>
16 </model>
```

117 models/a_forkbig/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_forkbig'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.071</mass>
10                 <pose>0.0027688 8.3438e-05 -2.608e-05 0 0 0</pose>
11                 <inertia>
12                     <ixx>2.6672e-07</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>8.0767e-07</iyy>
16                     <iyz>0</iyz>
17                     <izz>5.5867e-07</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://a_forkbig/a_forkbig
38                             .dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://a_forkbig/a_forkbig
54                             .dae</uri>
55                     </mesh>

```

```
51                                     </geometry>
52                               </visual>
53       </link>
54   </model>
55 </sdf>
```

118 models/a_{forkbig}/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_forkbig</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <description>
9      a_forkbig
10    </description>
11
12  </model>
```

119 models/a_siliconespatula/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_siliconespatula'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.122</mass>
10                 <pose>-0.016557 -0.0017901 -5.52e-05 0 0 0</pose>
11                 <inertia>
12                     <ixx>1.004e-06</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>3.4e-05</iyy>
16                     <iyz>0</iyz>
17                     <izz>3.3851e-05</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://a_siliconespatula/
38                             a_siliconespatula.dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://a_siliconespatula/
54                             a_siliconespatula.dae</uri>
55                     </mesh>

```



```
51                                     </geometry>
52                               </visual>
53       </link>
54   </model>
55 </sdf>
```

120 models/*a_siliconespatula/model.config*

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_siliconespatula</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <description>
9      a_siliconespatula
10    </description>
11
12  </model>
```

121 models/a_{bowl}/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_bowl'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.407</mass>
10                 <pose>0.0002088 0.00026134 -0.00023605 0 0 0</pose>
11                 <inertia>
12                     <ixx>7.6228e-06</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>3.2294e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>1.6555e-06</izz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <mesh>
23                         <uri>model://a_bowl/a_bowl.dae</uri>
24                     </mesh>
25                 </geometry>
26                 <surface>
27                     <friction>
28                         <ode>
29                             <mu>0.2</mu>
30                             <mu2>0.2</mu2>
31                         </ode>
32                     </friction>
33                 </surface>
34             </collision>
35             <visual name='visual'>
36                 <geometry>
37                     <mesh>
38                         <uri>model://a_bowl/a_bowl.dae</uri>
39                     </mesh>
40                 </geometry>
41             </visual>
42         </link>
43     </model>
44 </sdf>

```

122 models/a_bowl/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_bowl</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <author>
9      <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10     <email>bryanwang1992@outlook.com</email>
11   </author>
12
13   <description>
14     a_bowl
15   </description>
16
17 </model>
```

123 models/a_chineseknife/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_chineseknife'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.276</mass>
10                 <pose>0.00069033 -0.0012369 -0.00043514 0 0 0</pose>
11                 <inertia>
12                     <ixx>4.5353e-06</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>3.0548e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>8.4999e-07</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://a_chineseknife/
38                             a_chineseknife.dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://a_chineseknife/
54                             a_chineseknife.dae</uri>
55                     </mesh>

```

```
51                                     </geometry>
52                               </visual>
53       </link>
54   </model>
55 </sdf>
```

124 models/*a_chineseknife*/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_chineseknife</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <description>
9      a_chineseknife
10    </description>
11
12  </model>
```

125 models/b_{pot}/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3    <model name='b_pot'>
4      <static>false</static>
5      <pose>0 0 0 0 0 0</pose>
6
7      <link name='link'>
8        <inertial>
9          <mass>0.40</mass>
10         <pose>0.000382297035518770      -0.000149204207528814
11           0.00495379249275721 0 0 0</pose>
12         <inertia>
13           <ixx>7.972462473661376e-05</ixx>
14           <ixy>0.0</ixy>
15           <ixz>0.0</ixz>
16           <iyy>9.743942735555959e-05</iyy>
17           <iyz>0.0</iyz>
18           <izz>3.897022921041362e-05</izz>
19         </inertia>
20       </inertial>
21
22       <collision name='collision'>
23         <geometry>
24           <mesh>
25             <uri>model://b_pot/b_pot.dae</uri>
26           </mesh>
27         </geometry>
28         <surface>
29           <friction>
30             <ode>
31               <mu>0.2</mu>
32               <mu2>0.2</mu2>
33             </ode>
34           </friction>
35         </surface>
36       </collision>
37
38       <visual name='visual'>
39         <geometry>
40           <mesh>
41             <uri>model://b_pot/b_pot.dae</uri>
42           </mesh>
43         </geometry>
44       </visual>
45     </link>
46   </model>
47 </sdf>

```


126 $\text{models/b}_{\text{pot}}/\text{model.config}$

```
1  <?xml version="1.0"?>
2
3  <model>
4      <name>b_pot</name>
5      <version>1.0</version>
6      <sdf version='1.6'>model.sdf</sdf>
7
8      <author>
9          <name>Pawel Gajewski</name>
10         <email>pawel.gajewski@agh.edu.pl</email>
11     </author>
12
13     <description>
14         IAI lab pot.
15     </description>
16 </model>
```

127 models/bookshelf/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3    <model name='bookshelf_'>
4      <model name='shelf'>
5        <link name='link_0'>
6          <pose frame=''>-0.007971 1.02332 0.68125 0 -0 0</pose>
7          <inertial>
8            <mass>1</mass>
9            <inertia>
10             <ixx>0.166667</ixx>
11             <ixy>0</ixy>
12             <ixz>0</ixz>
13             <iyy>0.166667</iyy>
14             <iyz>0</iyz>
15             <izz>0.166667</izz>
16           </inertia>
17           <pose frame=''>0 0 0 0 -0 0</pose>
18         </inertial>
19         <gravity>1</gravity>
20         <self_collide>0</self_collide>
21         <kinematic>0</kinematic>
22         <visual name='visual'>
23           <pose frame=''>0 0 0 0 -0 0</pose>
24           <geometry>
25             <box>
26               <size>0.05 1 0.5</size>
27             </box>
28           </geometry>
29           <material>
30             <lighting>1</lighting>
31             <script>
32               <uri>file://media/materials/scripts/gazebo.material</uri>
33               <name>Gazebo/Grey</name>
34             </script>
35             <ambient>0.3 0.3 0.3 1</ambient>
36             <diffuse>0.7 0.7 0.7 1</diffuse>
37             <specular>0.01 0.01 0.01 1</specular>
38             <emissive>0 0 0 1</emissive>
39             <shader type='vertex'>
40               <normal_map>__default__</normal_map>
41             </shader>
42           </material>
43           <transparency>0</transparency>
44           <cast_shadows>1</cast_shadows>
45         </visual>
46         <collision name='collision'>
47           <laser_retro>0</laser_retro>
48           <max_contacts>10</max_contacts>
49           <pose frame=''>0 0 0 0 -0 0</pose>
50           <geometry>
51             <box>
52               <size>0.05 1 0.5</size>
53             </box>
54           </geometry>

```

```

55     <surface>
56         <friction>
57             <ode>
58                 <mu>1</mu>
59                 <mu2>1</mu2>
60                 <fdir1>0 0 0</fdir1>
61                 <slip1>0</slip1>
62                 <slip2>0</slip2>
63             </ode>
64             <torsional>
65                 <coefficient>1</coefficient>
66                 <patch_radius>0</patch_radius>
67                 <surface_radius>0</surface_radius>
68                 <use_patch_radius>1</use_patch_radius>
69             <ode>
70                 <slip>0</slip>
71             </ode>
72         </torsional>
73     </friction>
74     <bounce>
75         <restitution_coefficient>0</restitution_coefficient>
76         <threshold>1e+06</threshold>
77     </bounce>
78     <contact>
79         <collide_without_contact>0</collide_without_contact>
80         <collide_without_contact_bitmask>1</
            collide_without_contact_bitmask>
81         <collide_bitmask>1</collide_bitmask>
82         <ode>
83             <soft_cfm>0</soft_cfm>
84             <soft_erp>0.2</soft_erp>
85             <kp>1e+13</kp>
86             <kd>1</kd>
87             <max_vel>0.01</max_vel>
88             <min_depth>0</min_depth>
89         </ode>
90         <bullet>
91             <split_impulse>1</split_impulse>
92             <split_impulse_penetration_threshold>-0.01</
                split_impulse_penetration_threshold>
93             <soft_cfm>0</soft_cfm>
94             <soft_erp>0.2</soft_erp>
95             <kp>1e+13</kp>
96             <kd>1</kd>
97         </bullet>
98     </contact>
99 </surface>
100 </collision>
101 </link>
102 <link name='link_0_clone'>
103     <pose frame=''>0.167029 1.02332 0.45625 0 -0 0</pose>
104     <inertial>
105         <mass>1</mass>
106         <inertia>
107             <ixx>0.166667</ixx>
108             <ixy>0</ixy>
109             <ixz>0</ixz>

```

```

110     <iyy>0.166667</iyy>
111     <iyz>0</iyz>
112     <izz>0.166667</izz>
113 </inertia>
114     <pose frame=''>0 0 0 0 -0 0</pose>
115 </inertial>
116 <self_collide>0</self_collide>
117 <kinematic>0</kinematic>
118 <gravity>1</gravity>
119 <visual name='visual'>
120     <pose frame=''>0 0 0 0 -0 0</pose>
121     <geometry>
122         <box>
123             <size>0.3 1 0.05</size>
124         </box>
125     </geometry>
126     <material>
127         <lighting>1</lighting>
128         <script>
129             <uri>file://media/materials/scripts/gazebo.material</uri>
130             <name>Gazebo/Grey</name>
131         </script>
132         <ambient>0.3 0.3 0.3 1</ambient>
133         <diffuse>0.7 0.7 0.7 1</diffuse>
134         <specular>0.01 0.01 0.01 1</specular>
135         <emissive>0 0 0 1</emissive>
136         <shader type='vertex'>
137             <normal_map>__default__</normal_map>
138         </shader>
139     </material>
140     <transparency>0</transparency>
141     <cast_shadows>1</cast_shadows>
142 </visual>
143 <collision name='collision'>
144     <laser_retro>0</laser_retro>
145     <max_contacts>10</max_contacts>
146     <pose frame=''>0 0 0 0 -0 0</pose>
147     <geometry>
148         <box>
149             <size>0.3 1 0.05</size>
150         </box>
151     </geometry>
152     <surface>
153         <friction>
154             <ode>
155                 <mu>1</mu>
156                 <mu2>1</mu2>
157                 <fdir1>0 0 0</fdir1>
158                 <slip1>0</slip1>
159                 <slip2>0</slip2>
160             </ode>
161             <torsional>
162                 <coefficient>1</coefficient>
163                 <patch_radius>0</patch_radius>
164                 <surface_radius>0</surface_radius>
165                 <use_patch_radius>1</use_patch_radius>
166             </ode>

```

```

167         <slip>0</slip>
168     </ode>
169 </torsional>
170 </friction>
171 <bounce>
172     <restitution_coefficient>0</restitution_coefficient>
173     <threshold>1e+06</threshold>
174 </bounce>
175 <contact>
176     <collide_without_contact>0</collide_without_contact>
177     <collide_without_contact_bitmask>1</
        collide_without_contact_bitmask>
178     <collide_bitmask>1</collide_bitmask>
179     <ode>
180         <soft_cfm>0</soft_cfm>
181         <soft_erp>0.2</soft_erp>
182         <kp>1e+13</kp>
183         <kd>1</kd>
184         <max_vel>0.01</max_vel>
185         <min_depth>0</min_depth>
186     </ode>
187 <bullet>
188     <split_impulse>1</split_impulse>
189     <split_impulse_penetration_threshold>-0.01</
        split_impulse_penetration_threshold>
190     <soft_cfm>0</soft_cfm>
191     <soft_erp>0.2</soft_erp>
192     <kp>1e+13</kp>
193     <kd>1</kd>
194 </bullet>
195 </contact>
196 </surface>
197 </collision>
198 </link>
199 <link name='link_0_clone_0'>
200     <pose frame=''>0.142029 1.54832 0.68125 0 -0 0</pose>
201     <inertial>
202         <mass>1</mass>
203         <inertia>
204             <ixx>0.166667</ixx>
205             <ixy>0</ixy>
206             <ixz>0</ixz>
207             <iyy>0.166667</iyy>
208             <iyz>0</iyz>
209             <izz>0.166667</izz>
210         </inertia>
211         <pose frame=''>0 0 0 0 -0 0</pose>
212     </inertial>
213     <self_collide>0</self_collide>
214     <kinematic>0</kinematic>
215     <gravity>1</gravity>
216     <visual name='visual'>
217         <pose frame=''>0 0 0 0 -0 0</pose>
218         <geometry>
219             <box>
220                 <size>0.35 0.05 0.5</size>
221             </box>

```

```

222     </geometry>
223     <material>
224         <lighting>1</lighting>
225         <script>
226             <uri>file://media/materials/scripts/gazebo.material</uri>
227             <name>Gazebo/Grey</name>
228         </script>
229         <ambient>0.3 0.3 0.3 1</ambient>
230         <diffuse>0.7 0.7 0.7 1</diffuse>
231         <specular>0.01 0.01 0.01 1</specular>
232         <emissive>0 0 0 1</emissive>
233         <shader type='vertex'>
234             <normal_map>__default__</normal_map>
235         </shader>
236     </material>
237     <transparency>0</transparency>
238     <cast_shadows>1</cast_shadows>
239 </visual>
240 <collision name='collision'>
241     <laser_retro>0</laser_retro>
242     <max_contacts>10</max_contacts>
243     <pose frame=''>0 0 0 0 -0 0</pose>
244     <geometry>
245         <box>
246             <size>0.35 0.05 0.5</size>
247         </box>
248     </geometry>
249     <surface>
250         <friction>
251             <ode>
252                 <mu>1</mu>
253                 <mu2>1</mu2>
254                 <fdir1>0 0 0</fdir1>
255                 <slip1>0</slip1>
256                 <slip2>0</slip2>
257             </ode>
258             <torsional>
259                 <coefficient>1</coefficient>
260                 <patch_radius>0</patch_radius>
261                 <surface_radius>0</surface_radius>
262                 <use_patch_radius>1</use_patch_radius>
263             <ode>
264                 <slip>0</slip>
265             </ode>
266         </torsional>
267     </friction>
268     <bounce>
269         <restitution_coefficient>0</restitution_coefficient>
270         <threshold>1e+06</threshold>
271     </bounce>
272     <contact>
273         <collide_without_contact>0</collide_without_contact>
274         <collide_without_contact_bitmask>1</collide_without_contact_bitmask>
275         <collide_bitmask>1</collide_bitmask>
276         <ode>
277             <soft_cfm>0</soft_cfm>

```

```

278         <soft_erp>0.2</soft_erp>
279         <kp>1e+13</kp>
280         <kd>1</kd>
281         <max_vel>0.01</max_vel>
282         <min_depth>0</min_depth>
283     </ode>
284     <bullet>
285         <split_impulse>1</split_impulse>
286         <split_impulse_penetration_threshold>-0.01</
            split_impulse_penetration_threshold>
287         <soft_cfm>0</soft_cfm>
288         <soft_erp>0.2</soft_erp>
289         <kp>1e+13</kp>
290         <kd>1</kd>
291     </bullet>
292 </contact>
293 </surface>
294 </collision>
295 </link>
296 <link name='link_0_clone_0_clone'>
297     <pose frame=''>0.142028 0.498323 0.68125 0 -0 0</pose>
298     <inertial>
299         <mass>1</mass>
300         <inertia>
301             <ixx>0.166667</ixx>
302             <ixy>0</ixy>
303             <ixz>0</ixz>
304             <iyy>0.166667</iyy>
305             <iyz>0</iyz>
306             <izz>0.166667</izz>
307         </inertia>
308         <pose frame=''>0 0 0 0 -0 0</pose>
309     </inertial>
310     <self_collide>0</self_collide>
311     <kinematic>0</kinematic>
312     <gravity>1</gravity>
313     <visual name='visual'>
314         <pose frame=''>0 0 0 0 -0 0</pose>
315         <geometry>
316             <box>
317                 <size>0.35 0.05 0.5</size>
318             </box>
319         </geometry>
320         <material>
321             <lighting>1</lighting>
322             <script>
323                 <uri>file://media/materials/scripts/gazebo.material</uri>
324                 <name>Gazebo/Grey</name>
325             </script>
326             <ambient>0.3 0.3 0.3 1</ambient>
327             <diffuse>0.7 0.7 0.7 1</diffuse>
328             <specular>0.01 0.01 0.01 1</specular>
329             <emissive>0 0 0 1</emissive>
330             <shader type='vertex'>
331                 <normal_map>__default__</normal_map>
332             </shader>
333         </material>

```

```

334     <transparency>0</transparency>
335     <cast_shadows>1</cast_shadows>
336 </visual>
337 <collision name='collision'>
338     <laser_retro>0</laser_retro>
339     <max_contacts>10</max_contacts>
340     <pose frame=''>0 0 0 0 -0 0</pose>
341     <geometry>
342         <box>
343             <size>0.35 0.05 0.5</size>
344         </box>
345     </geometry>
346     <surface>
347         <friction>
348             <ode>
349                 <mu>1</mu>
350                 <mu2>1</mu2>
351                 <fdir1>0 0 0</fdir1>
352                 <slip1>0</slip1>
353                 <slip2>0</slip2>
354             </ode>
355             <torsional>
356                 <coefficient>1</coefficient>
357                 <patch_radius>0</patch_radius>
358                 <surface_radius>0</surface_radius>
359                 <use_patch_radius>1</use_patch_radius>
360             <ode>
361                 <slip>0</slip>
362             </ode>
363             </torsional>
364         </friction>
365         <bounce>
366             <restitution_coefficient>0</restitution_coefficient>
367             <threshold>1e+06</threshold>
368         </bounce>
369         <contact>
370             <collide_without_contact>0</collide_without_contact>
371             <collide_without_contact_bitmask>1</collide_without_contact_bitmask>
372             <collide_bitmask>1</collide_bitmask>
373             <ode>
374                 <soft_cfm>0</soft_cfm>
375                 <soft_erp>0.2</soft_erp>
376                 <kp>1e+13</kp>
377                 <kd>1</kd>
378                 <max_vel>0.01</max_vel>
379                 <min_depth>0</min_depth>
380             </ode>
381             <bullet>
382                 <split_impulse>1</split_impulse>
383                 <split_impulse_penetration_threshold>-0.01</split_impulse_penetration_threshold>
384                 <soft_cfm>0</soft_cfm>
385                 <soft_erp>0.2</soft_erp>
386                 <kp>1e+13</kp>
387                 <kd>1</kd>
388             </bullet>

```



```

389         </contact>
390     </surface>
391 </collision>
392 </link>
393 <joint name='link_0_clone_JOINT_0' type='fixed'>
394     <parent>link_0_clone</parent>
395     <child>link_0</child>
396     <pose frame=''>0 0 0 0 -0 0</pose>
397     <physics>
398         <ode>
399             <limit>
400                 <cfm>0</cfm>
401                 <erp>0.2</erp>
402             </limit>
403             <suspension>
404                 <cfm>0</cfm>
405                 <erp>0.2</erp>
406             </suspension>
407         </ode>
408     </physics>
409 </joint>
410 <joint name='link_0_clone_JOINT_1' type='fixed'>
411     <parent>link_0_clone</parent>
412     <child>link_0_clone_0</child>
413     <pose frame=''>0 0 0 0 -0 0</pose>
414     <physics>
415         <ode>
416             <limit>
417                 <cfm>0</cfm>
418                 <erp>0.2</erp>
419             </limit>
420             <suspension>
421                 <cfm>0</cfm>
422                 <erp>0.2</erp>
423             </suspension>
424         </ode>
425     </physics>
426 </joint>
427 <joint name='link_0_clone_JOINT_2' type='fixed'>
428     <parent>link_0_clone</parent>
429     <child>link_0_clone_0</child>
430     <pose frame=''>0 0 0 0 -0 0</pose>
431     <physics>
432         <ode>
433             <limit>
434                 <cfm>0</cfm>
435                 <erp>0.2</erp>
436             </limit>
437             <suspension>
438                 <cfm>0</cfm>
439                 <erp>0.2</erp>
440             </suspension>
441         </ode>
442     </physics>
443 </joint>
444 <static>1</static>
445 <allow_auto_disable>1</allow_auto_disable>

```

```
446         <pose frame=''>0 -2e-06 0 0 -0 0</pose>
447     </model>
448     <static>1</static>
449     <allow_auto_disable>1</allow_auto_disable>
450 </model>
451 </sdf>
```

128 models/bookshelf/*model.config*

```
1  <?xml version="1.0" ?>
2  <model>
3      <name>bookshelf</name>
4      <version>1.0</version>
5      <sdf version="1.6">model.sdf</sdf>
6      <author>
7          <name></name>
8          <email></email>
9      </author>
10     <description></description>
11 </model>
```

129 models/b_{red}_{mug}/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='b_red_mug'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.096</mass>
10                 <pose>-0.00011045 0.0017861 0.0028209 0 0 0</pose>
11                 <inertia>
12                     <ixx>1.66e-06</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>1.357e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>7.1669e-07</izz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <mesh>
23                         <uri>model://b_red_mug/b_red_mug
24                             .dae</uri>
25                     </mesh>
26                 </geometry>
27                 <surface>
28                     <friction>
29                         <ode>
30                             <mu>0.2</mu>
31                             <mu2>0.2</mu2>
32                         </ode>
33                     </friction>
34                 </surface>
35             </collision>
36             <visual name='visual'>
37                 <geometry>
38                     <mesh>
39                         <uri>model://b_red_mug/b_red_mug
40                             .dae</uri>
41                     </mesh>
42                 </geometry>
43             </visual>
44         </link>
45     </model>
46 </sdf>

```

130 `models/bredmug/model.config`

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>b_red_mug</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <author>
9      <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10     <email>bryanwang1992@outlook.com</email>
11   </author>
12
13   <description>
14     b_red_mug
15   </description>
16
17 </model>
```

131 models/a_choppingboard/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_choppingboard'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.765</mass>
10                 <pose>0.00010961 -0.0013907 6.2505e-05 0 0 0</pose>
11                 <inertia>
12                     <ixx>4.7457e-06</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>7.247e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>1.4229e-05</izz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <mesh>
23                         <uri>model://a_choppingboard/
24                             a_choppingboard.dae</uri>
25                     </mesh>
26                 </geometry>
27                 <surface>
28                     <friction>
29                         <ode>
30                             <mu>0.2</mu>
31                             <mu2>0.2</mu2>
32                         </ode>
33                     </friction>
34                 </surface>
35             </collision>
36             <visual name='visual'>
37                 <geometry>
38                     <mesh>
39                         <uri>model://a_choppingboard/
40                             a_choppingboard.dae</uri>
41                     </mesh>
42                 </geometry>
43             </visual>
44         </link>
45     </model>
46 </sdf>

```

132 models/*a_choppingboard*/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_choppingboard</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <description>
9      a_choppingboard
10    </description>
11
12  </model>
```

133 models/a_spatulawoodgap2/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_spatulawoodgap2'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.12</mass>
10                 <pose>-0.040624 -0.010626 5.3115e-05 0 0 0</pose>
11                 <inertia>
12                     <ixx>1.3576e-05</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>0.00019859</iyy>
16                     <iyz>0</iyz>
17                     <izz>0.00021235</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://a_spatulawoodgap2/
38                             a_spatulawoodgap2.dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://a_spatulawoodgap2/
54                             a_spatulawoodgap2.dae</uri>
55                     </mesh>

```



```
51                                     </geometry>
52                               </visual>
53       </link>
54   </model>
55 </sdf>
```

134 models/a_spatulawoodgap2/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_spatulawoodgap2</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <description>
9      a_spatulawoodgap2
10    </description>
11
12  </model>
```

135 models/b_kknife/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3    <model name='b_knife'>
4      <static>false</static>
5      <pose>0 0 0 0 0 0</pose>
6
7      <link name='link'>
8        <inertial>
9          <mass>0.40</mass>
10         <pose>0.000382297035518770      -0.000149204207528814
11           0.00495379249275721 0 0 0</pose>
12         <inertia>
13           <ixx>7.972462473661376e-05</ixx>
14           <ixy>0.0</ixy>
15           <ixz>0.0</ixz>
16           <iyy>9.743942735555959e-05</iyy>
17           <iyz>0.0</iyz>
18           <izz>3.897022921041362e-05</izz>
19         </inertia>
20       </inertial>
21       <sensor name="tool_contact_sensor" type="contact">
22         <always_on>true</always_on>
23         <update_rate>30.0</update_rate>
24         <contact>
25           <collision>collision</collision>
26         </contact>
27         <plugin name="tool_bumper" filename="
28           libgazebo_ros_bumper.so">
29           <bumperTopicName>
30             tool_contact_sensor_state</
31             bumperTopicName>
32           <frameName>world</frameName>
33         </plugin>
34       </sensor>
35       <collision name='collision'>
36         <geometry>
37           <mesh>
38             <uri>model://b_knife/b_knife.dae</uri>
39           </mesh>
40         </geometry>
41         <surface>
42           <friction>
43             <ode>
44               <mu>0.2</mu>
45               <mu2>0.2</mu2>
46             </ode>
47           </friction>
48         </surface>
49       </collision>
50       <visual name='visual'>
51         <geometry>
52           <mesh>
53             <uri>model://b_knife/b_knife.dae</uri>
54           </mesh>
55         </geometry>

```

```
52         </visual>
53     </link>
54 </model>
55 </sdf>
```

136 models/b_kknife/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>b_knife</name>
5    <version>1.0</version>
6    <sdf version='1.6'>model.sdf</sdf>
7
8    <author>
9      <name>Pawel Gajewski</name>
10     <email>pawel.gajewski@agh.edu.pl</email>
11   </author>
12
13   <description>
14     IAI lab knife.
15   </description>
16 </model>
```

137 models/table/model.sdf

```
1 <?xml version="1.0" ?>
2 <sdf version="1.5">
3   <model name="table">
4     <static>true</static>
5     <link name="link">
6       <collision name="surface">
7         <pose>0 0 1.0 0 0 0</pose>
8         <geometry>
9           <box>
10            <size>1.5 0.8 0.03</size>
11          </box>
12        </geometry>
13        <surface>
14          <friction>
15            <ode>
16              <mu>0.6</mu>
17              <mu2>0.6</mu2>
18            </ode>
19          </friction>
20        </surface>
21      </collision>
22      <visual name="visual1">
23        <pose>0 0 1.0 0 0 0</pose>
24        <geometry>
25          <box>
26            <size>1.5 0.8 0.03</size>
27          </box>
28        </geometry>
29        <material>
30          <script>
31            <uri>file://media/materials/scripts/gazebo.material</uri>
32            <name>Gazebo/Wood</name>
33          </script>
34        </material>
35      </visual>
36      <collision name="front_left_leg">
37        <pose>0.68 0.38 0.5 0 0 0</pose>
38        <geometry>
39          <cylinder>
40            <radius>0.02</radius>
41            <length>1.0</length>
42          </cylinder>
43        </geometry>
44      </collision>
45      <visual name="front_left_leg">
46        <pose>0.68 0.38 0.5 0 0 0</pose>
47        <geometry>
48          <cylinder>
49            <radius>0.02</radius>
50            <length>1.0</length>
51          </cylinder>
52        </geometry>
53        <material>
54          <script>
55            <uri>file://media/materials/scripts/gazebo.material</uri>
```

```

56         <name>Gazebo/Grey</name>
57     </script>
58 </material>
59 </visual>
60 <collision name="front_right_leg">
61     <pose>0.68 -0.38 0.5 0 0 0</pose>
62     <geometry>
63         <cylinder>
64             <radius>0.02</radius>
65             <length>1.0</length>
66         </cylinder>
67     </geometry>
68 </collision>
69 <visual name="front_right_leg">
70     <pose>0.68 -0.38 0.5 0 0 0</pose>
71     <geometry>
72         <cylinder>
73             <radius>0.02</radius>
74             <length>1.0</length>
75         </cylinder>
76     </geometry>
77 <material>
78     <script>
79         <uri>file://media/materials/scripts/gazebo.material</uri>
80         <name>Gazebo/Grey</name>
81     </script>
82 </material>
83 </visual>
84 <collision name="back_right_leg">
85     <pose>-0.68 -0.38 0.5 0 0 0</pose>
86     <geometry>
87         <cylinder>
88             <radius>0.02</radius>
89             <length>1.0</length>
90         </cylinder>
91     </geometry>
92 </collision>
93 <visual name="back_right_leg">
94     <pose>-0.68 -0.38 0.5 0 0 0</pose>
95     <geometry>
96         <cylinder>
97             <radius>0.02</radius>
98             <length>1.0</length>
99         </cylinder>
100    </geometry>
101 <material>
102     <script>
103         <uri>file://media/materials/scripts/gazebo.material</uri>
104         <name>Gazebo/Grey</name>
105     </script>
106 </material>
107 </visual>
108 <collision name="back_left_leg">
109     <pose>-0.68 0.38 0.5 0 0 0</pose>
110     <geometry>
111         <cylinder>
112             <radius>0.02</radius>

```

```

113         <length>1.0</length>
114     </cylinder>
115 </geometry>
116 </collision>
117 <visual name="back_left_leg">
118     <pose>-0.68 0.38 0.5 0 0 0</pose>
119     <geometry>
120         <cylinder>
121             <radius>0.02</radius>
122             <length>1.0</length>
123         </cylinder>
124     </geometry>
125     <material>
126         <script>
127             <uri>file://media/materials/scripts/gazebo.material</uri>
128             <name>Gazebo/Grey</name>
129         </script>
130     </material>
131 </visual>
132 </link>
133 </model>
134 </sdf>

```


138 models/table/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>table</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <author>
9      <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
        name>
10     <email>bryanwang1992@outlook.com</email>
11   </author>
12
13   <description>
14     a table
15   </description>
16
17 </model>
```

139 models/gripper/model.sdf

```
1 <?xml version='1.0'?>
2 <sdf version='1.6'>
3   <model name='gripper'>
4     <static>false</static>
5     <allow_auto_disable>false</allow_auto_disable>
6
7     <pose>0 0 0 0 0 0</pose>
8
9     <link name='link'>
10      <pose>0 0 0 0 0 0</pose>
11
12      <!-- <inertial>
13        <mass>5.0</mass>
14        <pose>0 0 0 0 0 0</pose>
15        <inertia>
16          <ixx>0.0008</ixx>
17          <iyy>0.0008</iyy>
18          <izz>0.0008</izz>
19        </inertia>
20      </inertial> -->
21
22      <gravity>false</gravity>
23
24      <!-- <collision name='collision'>-->
25      <!-- <geometry>-->
26      <!-- <sphere>-->
27      <!-- <radius>0.02</radius>-->
28      <!-- </sphere>-->
29      <!-- </geometry>-->
30      <!-- </collision>-->
31
32      <visual name='visual'>
33        <geometry>
34          <sphere>
35            <radius>0.02</radius>
36          </sphere>
37        </geometry>
38      </visual>
39
40    </link>
41  </model>
42 </sdf>
```

140 models/gripper/model.config

```
1 <?xml version='1.0'?>
2
3 <model>
4   <name>gripper</name>
5   <version>1.0</version>
6   <sdf version='1.6'>model.sdf</sdf>
7
8   <author>
9     <name>me</name>
10    <email>somebody@somewhere.com</email>
11  </author>
12
13  <description>
14    A simple gripper.
15  </description>
16 </model>
```

141 models/b_serving_spoon/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='b_serving_spoon'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.15</mass>
10                 <pose>0.0019638 -6.1791e-05 0.00018857 0 0 0</pose>
11                 <inertia>
12                     <ixx>0.0000075</ixx>
13                     <iyy>0.00112875</iyy>
14                     <izz>0.00112875</izz>
15                 </inertia>
16             </inertial>
17             <sensor name="tool_contact_sensor" type="contact">
18                 <always_on>true</always_on>
19                 <update_rate>30.0</update_rate>
20                 <contact>
21                     <collision>collision</collision>
22                 </contact>
23                 <plugin name="tool_bumper" filename="
24                     libgazebo_ros_bumper.so">
25                     <bumperTopicName>
26                         tool_contact_sensor_state</
27                         bumperTopicName>
28                     <frameName>world</frameName>
29                 </plugin>
30             </sensor>
31             <collision name='collision'>
32                 <geometry>
33                     <mesh>
34                         <uri>model://b_serving_spoon/
35                             b_serving_spoon.dae</uri>
36                     </mesh>
37                 </geometry>
38                 <surface>
39                     <friction>
40                         <ode>
41                             <mu>0.2</mu>
42                             <mu2>0.2</mu2>
43                         </ode>
44                     </friction>
45                 </surface>
46             </collision>
47             <visual name='visual'>
48                 <geometry>
49                     <mesh>
50                         <uri>model://b_serving_spoon/
51                             b_serving_spoon.dae</uri>
52                     </mesh>
53                 </geometry>
54             </visual>
55         </link>
56     </model>
57 </sdf>

```

```
51      </model>
52    </sdf>
```

142 `models/b_serving_spoon/model.config`

```
1 <?xml version="1.0"?>
2
3 <model>
4   <name>b_serving_spoon</name>
5   <version>1.0</version>
6   <sdf version="1.6">model.sdf</sdf>
7
8   <author>
9     <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10    <email>bryanwang1992@outlook.com</email>
11  </author>
12
13  <description>
14    b_serving_spoon
15  </description>
16
17 </model>
```

143 models/b_coffee_cup/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='b_coffee_cup'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.1</mass>
10                 <pose>-2.03e-05 0.001225 -0.00019831 0 0 0</pose>
11                 <inertia>
12                     <ixx>7.571e-07</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>6.1374e-07</iyy>
16                     <iyz>0</iyz>
17                     <izz>6.0131e-07</izz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <mesh>
23                         <uri>model://b_coffee_cup/
24                             b_coffee_cup.dae</uri>
25                     </mesh>
26                 </geometry>
27                 <surface>
28                     <friction>
29                         <ode>
30                             <mu>0.2</mu>
31                             <mu2>0.2</mu2>
32                         </ode>
33                     </friction>
34                 </surface>
35             </collision>
36             <visual name='visual'>
37                 <geometry>
38                     <mesh>
39                         <uri>model://b_coffee_cup/
40                             b_coffee_cup.dae</uri>
41                     </mesh>
42                 </geometry>
43             </visual>
44         </link>
45     </model>
46 </sdf>

```

144 `models/bcoffeecup/model.config`

```
1 <?xml version="1.0"?>
2
3 <model>
4   <name>b_coffee_cup</name>
5   <version>1.0</version>
6   <sdf version="1.6">model.sdf</sdf>
7
8   <author>
9     <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10    <email>bryanwang1992@outlook.com</email>
11  </author>
12
13  <description>
14    b_coffeecup
15  </description>
16
17 </model>
```


145 models/b_wildo_bowl/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3    <model name='b_wildo_bowl'>
4      <static>false</static>
5      <pose>0 0 0 0 0 0</pose>
6
7      <link name='link'>
8        <inertial>
9          <mass>0.40</mass>
10         <pose>0.000382297035518770      -0.000149204207528814
11           0.00495379249275721 0 0 0</pose>
12         <inertia>
13           <ixx>7.972462473661376e-05</ixx>
14           <ixy>0.0</ixy>
15           <ixz>0.0</ixz>
16           <iyy>9.743942735555959e-05</iyy>
17           <iyz>0.0</iyz>
18           <izz>3.897022921041362e-05</izz>
19         </inertia>
20       </inertial>
21
22       <collision name='collision'>
23         <geometry>
24           <mesh>
25             <uri>model://b_wildo_bowl/b_wildo_bowl.dae</uri>
26           </mesh>
27         </geometry>
28         <surface>
29           <friction>
30             <ode>
31               <mu>0.2</mu>
32               <mu2>0.2</mu2>
33             </ode>
34           </friction>
35         </surface>
36       </collision>
37
38       <visual name='visual'>
39         <geometry>
40           <mesh>
41             <uri>model://b_wildo_bowl/b_wildo_bowl.dae</uri>
42           </mesh>
43         </geometry>
44       </visual>
45     </link>
46   </model>
47 </sdf>

```

146 models/b_wildo_bowl/model.config

```
1 <?xml version="1.0"?>
2
3 <model>
4   <name>b_wildo_bowl</name>
5   <version>1.0</version>
6   <sdf version='1.6'>model.sdf</sdf>
7
8   <author>
9     <name>Pawel Gajewski</name>
10    <email>pawel.gajewski@agh.edu.pl</email>
11  </author>
12
13  <description>
14    IAI lab wildo bowl.
15  </description>
16 </model>
```

147 models/freezer_box/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3    <model name='freezer_box'>
4      <link name='link'>
5        <pose frame=''>0 0 0 -0 0</pose>
6        <inertial>
7          <mass>1</mass>
8          <inertia>
9            <ixx>0.166667</ixx>
10           <ixy>0</ixy>
11           <ixz>0</ixz>
12           <iyy>0.166667</iyy>
13           <iyz>0</iyz>
14           <izz>0.166667</izz>
15         </inertia>
16         <pose frame=''>0 0 0 -0 0</pose>
17       </inertial>
18       <self_collide>0</self_collide>
19       <kinematic>0</kinematic>
20       <gravity>1</gravity>
21       <visual name='visual'>
22         <geometry>
23           <box>
24             <size>1 1 0.01</size>
25           </box>
26         </geometry>
27         <material>
28           <script>
29             <name>Gazebo/Grey</name>
30             <uri>file://media/materials/scripts/gazebo.material</uri>
31           </script>
32           <ambient>0.3 0.3 0.3 1</ambient>
33           <diffuse>0.7 0.7 0.7 1</diffuse>
34           <specular>0.01 0.01 0.01 1</specular>
35           <emissive>0 0 0 1</emissive>
36           <shader type='vertex'>
37             <normal_map>__default__</normal_map>
38           </shader>
39         </material>
40         <pose frame=''>0 0 0 -0 0</pose>
41         <transparency>0</transparency>
42         <cast_shadows>1</cast_shadows>
43       </visual>
44       <collision name='collision'>
45         <laser_retro>0</laser_retro>
46         <max_contacts>10</max_contacts>
47         <pose frame=''>0 0 0 -0 0</pose>
48         <geometry>
49           <box>
50             <size>1 1 0.01</size>
51           </box>
52         </geometry>
53         <surface>
54           <friction>
55             <ode>

```

```

56         <mu>1</mu>
57         <mu2>1</mu2>
58         <fdir1>0 0 0</fdir1>
59         <slip1>0</slip1>
60         <slip2>0</slip2>
61     </ode>
62     <torsional>
63         <coefficient>1</coefficient>
64         <patch_radius>0</patch_radius>
65         <surface_radius>0</surface_radius>
66         <use_patch_radius>1</use_patch_radius>
67     </ode>
68     <slip>0</slip>
69 </ode>
70 </torsional>
71 </friction>
72 <bounce>
73     <restitution_coefficient>0</restitution_coefficient>
74     <threshold>1e+06</threshold>
75 </bounce>
76 <contact>
77     <collide_without_contact>0</collide_without_contact>
78     <collide_without_contact_bitmask>1</collide_without_contact_bitmask>
79     <collide_bitmask>1</collide_bitmask>
80     <ode>
81         <soft_cfm>0</soft_cfm>
82         <soft_erp>0.2</soft_erp>
83         <kp>1e+13</kp>
84         <kd>1</kd>
85         <max_vel>0.01</max_vel>
86         <min_depth>0</min_depth>
87     </ode>
88     <bullet>
89         <split_impulse>1</split_impulse>
90         <split_impulse_penetration_threshold>-0.01</
            split_impulse_penetration_threshold>
91         <soft_cfm>0</soft_cfm>
92         <soft_erp>0.2</soft_erp>
93         <kp>1e+13</kp>
94         <kd>1</kd>
95     </bullet>
96 </contact>
97 </surface>
98 </collision>
99 </link>
100 <link name='link_0'>
101     <pose frame=''>0 -0.493 0.243 0 -0 1.5708</pose>
102     <inertial>
103         <mass>1</mass>
104         <inertia>
105             <ixx>0.166667</ixx>
106             <ixy>0</ixy>
107             <ixz>0</ixz>
108             <iyy>0.166667</iyy>
109             <iyz>0</iyz>
110             <izz>0.166667</izz>
111         </inertia>

```

```

112     <pose frame=''>0 0 0 0 -0 0</pose>
113 </inertial>
114 <gravity>1</gravity>
115 <self_collide>0</self_collide>
116 <kinematic>0</kinematic>
117 <visual name='visual'>
118     <pose frame=''>0 0 0 0 -0 0</pose>
119     <geometry>
120         <box>
121             <size>0.01 1 0.5</size>
122         </box>
123     </geometry>
124     <material>
125         <lighting>1</lighting>
126         <script>
127             <uri>file://media/materials/scripts/gazebo.material</uri>
128             <name>Gazebo/Grey</name>
129         </script>
130         <ambient>0.3 0.3 0.3 1</ambient>
131         <diffuse>0.7 0.7 0.7 1</diffuse>
132         <specular>0.01 0.01 0.01 1</specular>
133         <emissive>0 0 0 1</emissive>
134         <shader type='vertex'>
135             <normal_map>__default__</normal_map>
136         </shader>
137     </material>
138     <transparency>0</transparency>
139     <cast_shadows>1</cast_shadows>
140 </visual>
141 <collision name='collision'>
142     <laser_retro>0</laser_retro>
143     <max_contacts>10</max_contacts>
144     <pose frame=''>0 0 0 0 -0 0</pose>
145     <geometry>
146         <box>
147             <size>0.01 1 0.5</size>
148         </box>
149     </geometry>
150     <surface>
151         <friction>
152             <ode>
153                 <mu>1</mu>
154                 <mu2>1</mu2>
155                 <fdir1>0 0 0</fdir1>
156                 <slip1>0</slip1>
157                 <slip2>0</slip2>
158             </ode>
159             <torsional>
160                 <coefficient>1</coefficient>
161                 <patch_radius>0</patch_radius>
162                 <surface_radius>0</surface_radius>
163                 <use_patch_radius>1</use_patch_radius>
164             </ode>
165             <slip>0</slip>
166         </ode>
167     </friction>
168 </surface>

```

```

169     <bounce>
170       <restitution_coefficient>0</restitution_coefficient>
171       <threshold>1e+06</threshold>
172     </bounce>
173     <contact>
174       <collide_without_contact>0</collide_without_contact>
175       <collide_without_contact_bitmask>1</collide_without_contact_bitmask>
176       <collide_bitmask>1</collide_bitmask>
177       <ode>
178         <soft_cfm>0</soft_cfm>
179         <soft_erp>0.2</soft_erp>
180         <kp>1e+13</kp>
181         <kd>1</kd>
182         <max_vel>0.01</max_vel>
183         <min_depth>0</min_depth>
184       </ode>
185       <bullet>
186         <split_impulse>1</split_impulse>
187         <split_impulse_penetration_threshold>-0.01</
            split_impulse_penetration_threshold>
188         <soft_cfm>0</soft_cfm>
189         <soft_erp>0.2</soft_erp>
190         <kp>1e+13</kp>
191         <kd>1</kd>
192       </bullet>
193     </contact>
194   </surface>
195 </collision>
196 </link>
197 <link name='link_0_clone'>
198   <pose frame=''>0.495 0 0.243 0 -0 0</pose>
199   <inertial>
200     <mass>1</mass>
201     <inertia>
202       <ixx>0.166667</ixx>
203       <ixy>0</ixy>
204       <ixz>0</ixz>
205       <iyy>0.166667</iyy>
206       <iyz>0</iyz>
207       <izz>0.166667</izz>
208     </inertia>
209     <pose frame=''>0 0 0 0 -0 0</pose>
210   </inertial>
211   <self_collide>0</self_collide>
212   <kinematic>0</kinematic>
213   <visual name='visual'>
214     <pose frame=''>0 0 0 0 -0 0</pose>
215     <geometry>
216       <box>
217         <size>0.01 1 0.5</size>
218       </box>
219     </geometry>
220     <material>
221       <lighting>1</lighting>
222       <script>
223         <uri>file://media/materials/scripts/gazebo.material</uri>
224         <name>Gazebo/Grey</name>

```

```

225     </script>
226     <ambient>0.3 0.3 0.3 1</ambient>
227     <diffuse>0.7 0.7 0.7 1</diffuse>
228     <specular>0.01 0.01 0.01 1</specular>
229     <emissive>0 0 0 1</emissive>
230     <shader type='vertex'>
231         <normal_map>__default__</normal_map>
232     </shader>
233 </material>
234 <transparency>0</transparency>
235 <cast_shadows>1</cast_shadows>
236 </visual>
237 <collision name='collision'>
238     <laser_retro>0</laser_retro>
239     <max_contacts>10</max_contacts>
240     <pose frame=''>0 0 0 0 -0 0</pose>
241     <geometry>
242         <box>
243             <size>0.01 1 0.5</size>
244         </box>
245     </geometry>
246     <surface>
247         <friction>
248             <ode>
249                 <mu>1</mu>
250                 <mu2>1</mu2>
251                 <fdir1>0 0 0</fdir1>
252                 <slip1>0</slip1>
253                 <slip2>0</slip2>
254             </ode>
255             <torsional>
256                 <coefficient>1</coefficient>
257                 <patch_radius>0</patch_radius>
258                 <surface_radius>0</surface_radius>
259                 <use_patch_radius>1</use_patch_radius>
260             <ode>
261                 <slip>0</slip>
262             </ode>
263         </friction>
264     </surface>
265     <bounce>
266         <restitution_coefficient>0</restitution_coefficient>
267         <threshold>1e+06</threshold>
268     </bounce>
269     <contact>
270         <collide_without_contact>0</collide_without_contact>
271         <collide_without_contact_bitmask>1</collide_without_contact_bitmask>
272         <collide_bitmask>1</collide_bitmask>
273         <ode>
274             <soft_cfm>0</soft_cfm>
275             <soft_erp>0.2</soft_erp>
276             <kp>1e+13</kp>
277             <kd>1</kd>
278             <max_vel>0.01</max_vel>
279             <min_depth>0</min_depth>
280         </ode>
281     </contact>
282 </bullet>

```

```

282         <split_impulse>1</split_impulse>
283         <split_impulse_penetration_threshold>-0.01</
            split_impulse_penetration_threshold>
284         <soft_cfm>0</soft_cfm>
285         <soft_erp>0.2</soft_erp>
286         <kp>1e+13</kp>
287         <kd>1</kd>
288     </bullet>
289 </contact>
290 </surface>
291 </collision>
292 </link>
293 <link name='link_0_clone_0'>
294   <pose frame=''>-0.495 0 0.243 0 -0 0</pose>
295   <inertial>
296     <mass>1</mass>
297     <inertia>
298       <ixx>0.166667</ixx>
299       <ixy>0</ixy>
300       <ixz>0</ixz>
301       <iyy>0.166667</iyy>
302       <iyz>0</iyz>
303       <izz>0.166667</izz>
304     </inertia>
305     <pose frame=''>0 0 0 0 -0 0</pose>
306   </inertial>
307   <self_collide>0</self_collide>
308   <kinematic>0</kinematic>
309   <visual name='visual'>
310     <pose frame=''>0 0 0 0 -0 0</pose>
311     <geometry>
312       <box>
313         <size>0.01 1 0.5</size>
314       </box>
315     </geometry>
316     <material>
317       <lighting>1</lighting>
318       <script>
319         <uri>file://media/materials/scripts/gazebo.material</uri>
320         <name>Gazebo/Grey</name>
321       </script>
322       <ambient>0.3 0.3 0.3 1</ambient>
323       <diffuse>0.7 0.7 0.7 1</diffuse>
324       <specular>0.01 0.01 0.01 1</specular>
325       <emissive>0 0 0 1</emissive>
326       <shader type='vertex'>
327         <normal_map>__default__</normal_map>
328       </shader>
329     </material>
330     <transparency>0</transparency>
331     <cast_shadows>1</cast_shadows>
332   </visual>
333   <collision name='collision'>
334     <laser_retro>0</laser_retro>
335     <max_contacts>10</max_contacts>
336     <pose frame=''>0 0 0 0 -0 0</pose>
337     <geometry>

```



```

338     <box>
339         <size>0.01 1 0.5</size>
340     </box>
341 </geometry>
342 <surface>
343     <friction>
344         <ode>
345             <mu>1</mu>
346             <mu2>1</mu2>
347             <fdir1>0 0 0</fdir1>
348             <slip1>0</slip1>
349             <slip2>0</slip2>
350         </ode>
351         <torsional>
352             <coefficient>1</coefficient>
353             <patch_radius>0</patch_radius>
354             <surface_radius>0</surface_radius>
355             <use_patch_radius>1</use_patch_radius>
356         <ode>
357             <slip>0</slip>
358         </ode>
359     </friction>
360 </surface>
361 <bounce>
362     <restitution_coefficient>0</restitution_coefficient>
363     <threshold>1e+06</threshold>
364 </bounce>
365 <contact>
366     <collide_without_contact>0</collide_without_contact>
367     <collide_without_contact_bitmask>1</collide_without_contact_bitmask>
368     <collide_bitmask>1</collide_bitmask>
369     <ode>
370         <soft_cfm>0</soft_cfm>
371         <soft_erp>0.2</soft_erp>
372         <kp>1e+13</kp>
373         <kd>1</kd>
374         <max_vel>0.01</max_vel>
375         <min_depth>0</min_depth>
376     </ode>
377     <bullet>
378         <split_impulse>1</split_impulse>
379         <split_impulse_penetration_threshold>-0.01</
            split_impulse_penetration_threshold>
380         <soft_cfm>0</soft_cfm>
381         <soft_erp>0.2</soft_erp>
382         <kp>1e+13</kp>
383         <kd>1</kd>
384     </bullet>
385 </contact>
386 </surface>
387 </collision>
388 </link>
389 <link name='link_0_clone_1'>
390     <pose frame=''>-0 0.495 0.243 0 -0 -1.5708</pose>
391     <inertial>
392         <mass>1</mass>
393         <inertia>

```

```

394     <ixx>0.166667</ixx>
395     <ixy>0</ixy>
396     <ixz>0</ixz>
397     <iyy>0.166667</iyy>
398     <iyz>0</iyz>
399     <izz>0.166667</izz>
400   </inertia>
401   <pose frame=''>0 0 0 0 -0 0</pose>
402 </inertial>
403 <self_collide>0</self_collide>
404 <kinematic>0</kinematic>
405 <visual name='visual'>
406   <pose frame=''>0 0 0 0 -0 0</pose>
407   <geometry>
408     <box>
409       <size>0.01 1 0.5</size>
410     </box>
411   </geometry>
412   <material>
413     <lighting>1</lighting>
414     <script>
415       <uri>file://media/materials/scripts/gazebo.material</uri>
416       <name>Gazebo/Grey</name>
417     </script>
418     <ambient>0.3 0.3 0.3 1</ambient>
419     <diffuse>0.7 0.7 0.7 1</diffuse>
420     <specular>0.01 0.01 0.01 1</specular>
421     <emissive>0 0 0 1</emissive>
422     <shader type='vertex'>
423       <normal_map>__default__</normal_map>
424     </shader>
425   </material>
426   <transparency>0</transparency>
427   <cast_shadows>1</cast_shadows>
428 </visual>
429 <collision name='collision'>
430   <laser_retro>0</laser_retro>
431   <max_contacts>10</max_contacts>
432   <pose frame=''>0 0 0 0 -0 0</pose>
433   <geometry>
434     <box>
435       <size>0.01 1 0.5</size>
436     </box>
437   </geometry>
438   <surface>
439     <friction>
440       <ode>
441         <mu>1</mu>
442         <mu2>1</mu2>
443         <fdir1>0 0 0</fdir1>
444         <slip1>0</slip1>
445         <slip2>0</slip2>
446       </ode>
447     <torsional>
448       <coefficient>1</coefficient>
449       <patch_radius>0</patch_radius>
450       <surface_radius>0</surface_radius>

```

```

451         <use_patch_radius>1</use_patch_radius>
452         <ode>
453             <slip>0</slip>
454         </ode>
455     </torsional>
456 </friction>
457 <bounce>
458     <restitution_coefficient>0</restitution_coefficient>
459     <threshold>1e+06</threshold>
460 </bounce>
461 <contact>
462     <collide_without_contact>0</collide_without_contact>
463     <collide_without_contact_bitmask>1</collide_without_contact_bitmask>
464     <collide_bitmask>1</collide_bitmask>
465     <ode>
466         <soft_cfm>0</soft_cfm>
467         <soft_erp>0.2</soft_erp>
468         <kp>1e+13</kp>
469         <kd>1</kd>
470         <max_vel>0.01</max_vel>
471         <min_depth>0</min_depth>
472     </ode>
473     <bullet>
474         <split_impulse>1</split_impulse>
475         <split_impulse_penetration_threshold>-0.01</
            split_impulse_penetration_threshold>
476         <soft_cfm>0</soft_cfm>
477         <soft_erp>0.2</soft_erp>
478         <kp>1e+13</kp>
479         <kd>1</kd>
480     </bullet>
481 </contact>
482 </surface>
483 </collision>
484 </link>
485 <joint name='link_JOINT_1' type='fixed'>
486     <parent>link</parent>
487     <child>link_0_clone_0</child>
488     <pose frame=''>0 0 0 0 -0 0</pose>
489     <physics>
490         <ode>
491             <limit>
492                 <cfm>0</cfm>
493                 <erp>0.2</erp>
494             </limit>
495             <suspension>
496                 <cfm>0</cfm>
497                 <erp>0.2</erp>
498             </suspension>
499         </ode>
500     </physics>
501 </joint>
502 <joint name='link_JOINT_5' type='fixed'>
503     <parent>link</parent>
504     <child>link_0_clone</child>
505     <pose frame=''>0 0 0 0 -0 0</pose>
506     <physics>

```

```

507     <ode>
508         <limit>
509             <cfm>0</cfm>
510             <erp>0.2</erp>
511         </limit>
512         <suspension>
513             <cfm>0</cfm>
514             <erp>0.2</erp>
515         </suspension>
516     </ode>
517 </physics>
518 </joint>
519 <joint name='link_JOINT_6' type='fixed'>
520     <parent>link</parent>
521     <child>link_0</child>
522     <pose frame=''>0 0 0 0 -0 0</pose>
523     <physics>
524         <ode>
525             <limit>
526                 <cfm>0</cfm>
527                 <erp>0.2</erp>
528             </limit>
529             <suspension>
530                 <cfm>0</cfm>
531                 <erp>0.2</erp>
532             </suspension>
533         </ode>
534     </physics>
535 </joint>
536 <joint name='link_JOINT_7' type='fixed'>
537     <parent>link</parent>
538     <child>link_0_clone_1</child>
539     <pose frame=''>0 0 0 0 -0 0</pose>
540     <physics>
541         <ode>
542             <limit>
543                 <cfm>0</cfm>
544                 <erp>0.2</erp>
545             </limit>
546             <suspension>
547                 <cfm>0</cfm>
548                 <erp>0.2</erp>
549             </suspension>
550         </ode>
551     </physics>
552 </joint>
553 <static>1</static>
554 <allow_auto_disable>1</allow_auto_disable>
555 </model>
556 </sdf>

```

148 models/freezer_{box}/model.config

```
1 <?xml version="1.0" ?>
2 <model>
3   <name>freezer_box</name>
4   <version>1.0</version>
5   <sdf version="1.6">model.sdf</sdf>
6   <author>
7     <name></name>
8     <email></email>
9   </author>
10  <description></description>
11 </model>
```

149 models/b_{big}owl/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='b_big_bowl'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.35</mass>
10                 <pose>-0.0022966 -0.0039142 0.0041527 0 0 0</pose>
11                 <inertia>
12                     <ixx>0.0009479167</ixx>
13                     <iyy>0.0009479167</iyy>
14                     <izz>0.00175</izz>
15                 </inertia>
16             </inertial>
17             <collision name='collision'>
18                 <geometry>
19                     <mesh>
20                         <uri>model://b_big_bowl/
21                             b_big_bowl.dae</uri>
22                     </mesh>
23                 </geometry>
24                 <surface>
25                     <friction>
26                         <ode>
27                             <mu>0.2</mu>
28                             <mu2>0.2</mu2>
29                         </ode>
30                     </friction>
31                 </surface>
32             </collision>
33             <visual name='visual'>
34                 <geometry>
35                     <mesh>
36                         <uri>model://b_big_bowl/
37                             b_big_bowl.dae</uri>
38                     </mesh>
39                 </geometry>
40             </visual>
41         </link>
42     </model>
43 </sdf>

```

150 models/*b_{big}bowl*/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>b_big_bowl</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <author>
9      <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10     <email>bryanwang1992@outlook.com</email>
11   </author>
12
13   <description>
14     b_big_bowl
15   </description>
16
17 </model>
```

151 models/a_{platebowl}/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_platebowl'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.425</mass>
10                 <pose>0.00041553 -0.00077162 9.9512e-05 0 0 0</pose>
11                 <inertia>
12                     <ixx>2.1909e-05</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>4.3318e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>3.9495e-06</izz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <mesh>
23                         <uri>model://a_platebowl/
24                             a_platebowl.dae</uri>
25                     </mesh>
26                 </geometry>
27                 <surface>
28                     <friction>
29                         <ode>
30                             <mu>0.2</mu>
31                             <mu2>0.2</mu2>
32                         </ode>
33                     </friction>
34                 </surface>
35             </collision>
36             <visual name='visual'>
37                 <geometry>
38                     <mesh>
39                         <uri>model://a_platebowl/
40                             a_platebowl.dae</uri>
41                     </mesh>
42                 </geometry>
43             </visual>
44         </link>
45     </model>
46 </sdf>

```


152 models/*a_platebowl*/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_platebowl</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <author>
9      <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
        name>
10     <email>bryanwang1992@outlook.com</email>
11   </author>
12
13   <description>
14     a_platebowl
15   </description>
16
17 </model>
```

153 models/b_thin_spatula/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='b_thin_spatula'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.11</mass>
10                 <pose>2.3574e-18 -4.8479e-20 1.6546e-18 0 0 0</pose>
11                 <inertia>
12                     <ixx>1.7189e-07</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>1.904e-07</iyy>
16                     <iyz>0</iyz>
17                     <izz>3.3856e-08</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://b_thin_spatula/
38                             b_thin_spatula.dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://b_thin_spatula/
54                             b_thin_spatula.dae</uri>
55                     </mesh>

```

```
51                                     </geometry>
52                               </visual>
53       </link>
54   </model>
55 </sdf>
```

154 `models/bthinspatula/model.config`

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>bthinspatula</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <author>
9      <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
        name>
10     <email>bryanwang1992@outlook.com</email>
11   </author>
12
13   <description>
14     bthinspatula
15   </description>
16
17 </model>
```

155 models/a_scraper/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_scraper'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.1</mass>
10                 <pose>-0.0078947 5.2477e-05 -9.0654e-05 0 0 0</pose>
11                 <inertia>
12                     <ixx>4.3449e-07</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>6.6601e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>6.2495e-06</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://a_scraper/a_scraper
38                             .dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://a_scraper/a_scraper
54                             .dae</uri>
55                     </mesh>

```

```
51                                     </geometry>
52                               </visual>
53       </link>
54   </model>
55 </sdf>
```

156 models/a_scraper/model.config

```
1 <?xml version="1.0"?>
2
3 <model>
4   <name>a_scraper</name>
5   <version>1.0</version>
6   <sdf version="1.6">model.sdf</sdf>
7
8   <description>
9     a_scraper
10  </description>
11
12 </model>
```

157 models/b_{table_knife}/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='b_table_knife'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.1</mass>
10                 <pose>-8.8541e-06 -4.0274e-05 -0.00010513 0 0 0</pose>
11                 <inertia>
12                     <ixx>0.000005</ixx>
13                     <iyy>0.000243333</iyy>
14                     <izz>0.000243333</izz>
15                 </inertia>
16             </inertial>
17             <sensor name="tool_contact_sensor" type="contact">
18                 <always_on>true</always_on>
19                 <update_rate>30.0</update_rate>
20                 <contact>
21                     <collision>collision</collision>
22                 </contact>
23                 <plugin name="tool_bumper" filename="
24                     libgazebo_ros_bumper.so">
25                     <bumperTopicName>
26                         tool_contact_sensor_state</
27                         bumperTopicName>
28                     <frameName>world</frameName>
29                 </plugin>
30             </sensor>
31             <collision name='collision'>
32                 <geometry>
33                     <mesh>
34                         <uri>model://b_table_knife/
35                             b_table_knife.dae</uri>
36                     </mesh>
37                 </geometry>
38                 <surface>
39                     <friction>
40                         <ode>
41                             <mu>0.2</mu>
42                             <mu2>0.2</mu2>
43                         </ode>
44                     </friction>
45                 </surface>
46             </collision>
47             <visual name='visual'>
48                 <geometry>
49                     <mesh>
50                         <uri>model://b_table_knife/
51                             b_table_knife.dae</uri>
52                     </mesh>
53                 </geometry>
54             </visual>
55         </link>

```



```
51      </model>
52    </sdf>
```

158 models/*b_table_knife*/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>b_table_knife</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <author>
9      <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10     <email>bryanwang1992@outlook.com</email>
11   </author>
12
13   <description>
14     b_table_knife
15   </description>
16
17 </model>
```

159 models/jenga_block/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3    <model name='jenga_block'>
4      <static>false</static>
5      <allow_auto_disable>false</allow_auto_disable>
6
7      <pose>0 0 0 0 0 0</pose>
8
9      <link name='link'>
10       <pose>0 0 0 0 0 0</pose>
11
12       <inertial>
13         <mass>0.0107</mass>
14         <pose>0 0 0 0 0 0</pose>
15         <inertia>
16           <ixx>0.000060745</ixx>
17           <iyy>0.000025078</iyy>
18           <izz>0.000020620</izz>
19         </inertia>
20       </inertial>
21
22       <gravity>true</gravity>
23
24       <collision name='collision'>
25         <geometry>
26           <box>
27             <size>0.015 0.025 0.075</size>
28           </box>
29         </geometry>
30         <surface>
31           <friction>
32             <ode>
33               <mu>1</mu>
34               <mu2>1</mu2>
35             </ode>
36           </friction>
37         </surface>
38       </collision>
39
40       <visual name='visual'>
41         <geometry>
42           <box>
43             <size>0.015 0.025 0.075</size>
44           </box>
45         </geometry>
46       </visual>
47
48     </link>
49   </model>
50 </sdf>

```

160 models/jenga_block/model.config

```
1 <?xml version="1.0" ?>
2 <model>
3   <name>finger</name>
4   <version>1.0</version>
5   <sdf version="1.6">model.sdf</sdf>
6   <author>
7     <name></name>
8     <email></email>
9   </author>
10  <description></description>
11 </model>
```

161 models/a_kknifekitchen3/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_knifekitchen3'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.22</mass>
10                 <pose>0.027414 0.0018516 0.006439 0 0 0</pose>
11                 <inertia>
12                     <ixx>1.4524e-05</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>0.00017907</iyy>
16                     <iyz>0</iyz>
17                     <izz>0.00016613</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://a_knifekitchen3/
38                             a_knifekitchen3.dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://a_knifekitchen3/
54                             a_knifekitchen3.dae</uri>
55                     </mesh>

```

```
51                                     </geometry>
52                               </visual>
53       </link>
54   </model>
55 </sdf>
```

162 models/*a_kknifekitchen3*/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_knifekitchen3</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <description>
9      a_knifekitchen3
10    </description>
11
12  </model>
```

163 models/a_{bowlchild}/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_bowlchild'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.051</mass>
10                 <pose>0.00062327 -0.00082628 9.9469e-05 0 0 0</pose>
11                 <inertia>
12                     <ixx>1.0588e-06</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>6.0902e-07</iyy>
16                     <iyz>0</iyz>
17                     <izz>6.8437e-07</izz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <mesh>
23                         <uri>model://a_bowlchild/
24                             a_bowlchild.dae</uri>
25                     </mesh>
26                 </geometry>
27                 <surface>
28                     <friction>
29                         <ode>
30                             <mu>0.2</mu>
31                             <mu2>0.2</mu2>
32                         </ode>
33                     </friction>
34                 </surface>
35             </collision>
36             <visual name='visual'>
37                 <geometry>
38                     <mesh>
39                         <uri>model://a_bowlchild/
40                             a_bowlchild.dae</uri>
41                     </mesh>
42                 </geometry>
43             </visual>
44         </link>
45     </model>
46 </sdf>

```


164 models/*a_bowlchild*/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_bowlchild</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <author>
9      <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10     <email>bryanwang1992@outlook.com</email>
11   </author>
12
13   <description>
14     a_bowlchild
15   </description>
16
17 </model>
```

165 models/book/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3    <model name='book'>
4      <static>false</static>
5      <pose>-0.031125 0 0.010809 1e-06 -0 0</pose>
6
7    <link name='book_link'>
8      <pose frame='link'>-0.031125 0 0.010809 1e-06 -0 0</pose>
9      <inertial>
10       <mass>1</mass>
11       <pose frame='link'>0.03 0 0.18 0 -0 0</pose>
12       <inertia>
13         <ixx>0.01495105</ixx><!-- 1/12 * m * (h^2 + d^2) -->
14         <ixy>0</ixy>
15         <ixz>0</ixz>
16         <iyy>0.01270166</iyy>
17         <iyz>0</iyz>
18         <izz>0.00247143</izz>
19       </inertia>
20     </inertial>
21     <collision name='book_collision'>
22       <geometry>
23         <mesh>
24           <uri>model://book/book.stl</uri>
25         </mesh>
26       </geometry>
27       <pose frame=''>0.26 0 -0.32 0 -0 0</pose>
28       <surface>
29         <friction>
30           <ode>
31             <mu>0.2</mu>
32             <mu2>0.2</mu2>
33           </ode>
34         </friction>
35       </surface>
36     </collision>
37     <visual name='book_visual'>
38       <geometry>
39         <mesh>
40           <uri>model://book/book.stl</uri>
41         </mesh>
42       </geometry>
43       <pose frame=''>0.26 0 -0.32 0 -0 0</pose>
44     </visual>
45   </link>
46 </model>
47 </sdf>

```

166 models/book/model.config

```
1 <?xml version="1.0" ?>
2 <model>
3   <name>book</name>
4   <version>1.0</version>
5   <sdf version="1.6">model.sdf</sdf>
6   <author>
7     <name></name>
8     <email></email>
9   </author>
10  <description></description>
11 </model>
```

167 models/finger/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='gripper'>
4          <static>false</static>
5          <allow_auto_disable>false</allow_auto_disable>
6
7          <pose>0 0 0 0 0 0</pose>
8
9          <link name='link'>
10             <pose>0 0 0 0 0 0</pose>
11
12             <!-- <inertial>
13                 <mass>5.0</mass>
14                 <pose>0 0 0 0 0 0</pose>
15                 <inertia>
16                     <ixx>0.0008</ixx>
17                     <iyy>0.0008</iyy>
18                     <izz>0.0008</izz>
19                 </inertia>
20             </inertial> -->
21
22             <gravity>false</gravity>
23
24             <collision name='collision'>
25                 <geometry>
26                     <box>
27                         <size>0.01 0.01 0.06</size>
28                     </box>
29                 </geometry>
30                 <surface>
31                     <friction>
32                         <ode>
33                             <mu>999</mu>
34                             <mu2>999</mu2>
35                         </ode>
36                     </friction>
37                 </surface>
38             </collision>
39
40             <visual name='visual'>
41                 <geometry>
42                     <box>
43                         <size>0.01 0.01 0.06</size>
44                     </box>
45                 </geometry>
46             </visual>
47
48         </link>
49     </model>
50 </sdf>

```

168 models/finger/model.config

```
1 <?xml version="1.0" ?>
2 <model>
3   <name>finger</name>
4   <version>1.0</version>
5   <sdf version="1.6">model.sdf</sdf>
6   <author>
7     <name></name>
8     <email></email>
9   </author>
10  <description></description>
11 </model>
```

169 models/a_mug2/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_mug2'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.329</mass>
10                 <pose>0.0010025 -0.00022342 -0.00040089 0 0 0</pose>
11                 <inertia>
12                     <ixx>1.3761e-06</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>1.227e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>8.7996e-07</izz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <mesh>
23                         <uri>model://a_mug2/a_mug2.dae</uri>
24                     </mesh>
25                 </geometry>
26                 <surface>
27                     <friction>
28                         <ode>
29                             <mu>0.2</mu>
30                             <mu2>0.2</mu2>
31                         </ode>
32                     </friction>
33                 </surface>
34             </collision>
35             <visual name='visual'>
36                 <geometry>
37                     <mesh>
38                         <uri>model://a_mug2/a_mug2.dae</uri>
39                     </mesh>
40                 </geometry>
41             </visual>
42         </link>
43     </model>
44 </sdf>

```

170 `models/amug2/model.config`

```
1 <?xml version="1.0"?>
2
3 <model>
4   <name>a_mug2</name>
5   <version>1.0</version>
6   <sdf version="1.6">model.sdf</sdf>
7
8   <description>
9     a_mug2
10  </description>
11
12 </model>
```

171 models/a_knifekitchen2/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_knifekitchen2'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.18</mass>
10                 <pose>0.0020611 -0.0005695 0.00029406 0 0 0</pose>
11                 <inertia>
12                     <ixx>9.051e-06</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>8.8029e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>1.0704e-06</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://a_knifekitchen2/
38                             a_knifekitchen2.dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://a_knifekitchen2/
54                             a_knifekitchen2.dae</uri>
55                     </mesh>

```



```
51                                     </geometry>
52                               </visual>
53       </link>
54   </model>
55 </sdf>
```

172 models/*a_kknifekitchen2*/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_knifekitchen2</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <description>
9      a_knifekitchen2
10    </description>
11
12  </model>
```

173 models/a_woodenspoon1/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_woodenspoon1'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.06</mass>
10                 <pose>-0.001351 0.00053629 -0.00033412 0 0 0</pose>
11                 <inertia>
12                     <ixx>1.1283e-06</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>1.0655e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>1.6291e-07</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://a_woodenspoon1/
38                             a_woodenspoon1.dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://a_woodenspoon1/
54                             a_woodenspoon1.dae</uri>
55                     </mesh>

```

```
51                                     </geometry>
52                               </visual>
53       </link>
54   </model>
55 </sdf>
```

174 models/a_woodenspoon1/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>a_woodenspoon1</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <description>
9      a_woodenspoon1
10    </description>
11
12  </model>
```

175 models/a_fryingpan/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='a_fryingpan'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.861</mass>
10                 <pose>0.0010123 0.00011913 0.00017042 0 0 0</pose>
11                 <inertia>
12                     <ixx>9.7907e-05</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>0.00026237</iyy>
16                     <iyz>0</iyz>
17                     <izz>0.00019284</izz>
18                 </inertia>
19             </inertial>
20             <collision name='collision'>
21                 <geometry>
22                     <mesh>
23                         <uri>model://a_fryingpan/
24                             a_fryingpan.dae</uri>
25                     </mesh>
26                 </geometry>
27                 <surface>
28                     <friction>
29                         <ode>
30                             <mu>0.2</mu>
31                             <mu2>0.2</mu2>
32                         </ode>
33                     </friction>
34                 </surface>
35             </collision>
36             <visual name='visual'>
37                 <geometry>
38                     <mesh>
39                         <uri>model://a_fryingpan/
40                             a_fryingpan.dae</uri>
41                     </mesh>
42                 </geometry>
43             </visual>
44         </link>
45     </model>
46 </sdf>

```

176 `models/a_fryingpan/model.config`

```
1 <?xml version="1.0"?>
2
3 <model>
4   <name>a_fryingpan</name>
5   <version>1.0</version>
6   <sdf version="1.6">model.sdf</sdf>
7
8   <author>
9     <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10    <email>bryanwang1992@outlook.com</email>
11  </author>
12
13  <description>
14    a_fryingpan
15  </description>
16
17 </model>
```

177 models/b_bucket/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3    <model name='b_bucket'>
4      <static>false</static>
5      <pose>0 0 0 0 0 0</pose>
6
7      <link name='link'>
8        <inertial>
9          <mass>0.40</mass>
10         <pose>0.000382297035518770      -0.000149204207528814
11           0.00495379249275721 0 0 0</pose>
12         <inertia>
13           <ixx>7.972462473661376e-05</ixx>
14           <ixy>0.0</ixy>
15           <ixz>0.0</ixz>
16           <iyy>9.743942735555959e-05</iyy>
17           <iyz>0.0</iyz>
18           <izz>3.897022921041362e-05</izz>
19         </inertia>
20       </inertial>
21
22       <collision name='collision'>
23         <geometry>
24           <mesh>
25             <uri>model://b_bucket/b_bucket.dae</uri>
26           </mesh>
27         </geometry>
28         <surface>
29           <friction>
30             <ode>
31               <mu>0.2</mu>
32               <mu2>0.2</mu2>
33             </ode>
34           </friction>
35         </surface>
36       </collision>
37
38       <visual name='visual'>
39         <geometry>
40           <mesh>
41             <uri>model://b_bucket/b_bucket.dae</uri>
42           </mesh>
43         </geometry>
44       </visual>
45     </link>
46   </model>
47 </sdf>

```


178 models/b_bucket/model.config

```
1  <?xml version="1.0"?>
2
3  <model>
4      <name>b_bucket</name>
5      <version>1.0</version>
6      <sdf version='1.6'>model.sdf</sdf>
7
8      <author>
9          <name>Pawel Gajewski</name>
10         <email>pawel.gajewski@agh.edu.pl</email>
11     </author>
12
13     <description>
14         IAI lab bucket.
15     </description>
16 </model>
```

179 models/b_small_knife/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='b_small_knife'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.15</mass>
10                 <pose>1.6078e-05 -1.0847e-05 -1.9891e-07 0 0 0</pose>
11                 <inertia>
12                     <ixx>6.914e-10</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>1.0684e-09</iyy>
16                     <iyz>0</iyz>
17                     <izz>1.5341e-09</izz>
18                 </inertia>
19             </inertial>
20             <sensor name="tool_contact_sensor" type="contact">
21                 <always_on>true</always_on>
22                 <update_rate>30.0</update_rate>
23                 <contact>
24                     <collision>collision</collision>
25                 </contact>
26                 <plugin name="tool_bumper" filename="
27                     libgazebo_ros_bumper.so">
28                     <bumperTopicName>
29                         tool_contact_sensor_state</
30                         bumperTopicName>
31                     <frameName>world</frameName>
32                 </plugin>
33             </sensor>
34             <collision name='collision'>
35                 <geometry>
36                     <mesh>
37                         <uri>model://b_small_knife/
38                             b_small_knife.dae</uri>
39                     </mesh>
40                 </geometry>
41                 <surface>
42                     <friction>
43                         <ode>
44                             <mu>0.2</mu>
45                             <mu2>0.2</mu2>
46                         </ode>
47                     </friction>
48                 </surface>
49             </collision>
50             <visual name='visual'>
51                 <geometry>
52                     <mesh>
53                         <uri>model://b_small_knife/
54                             b_small_knife.dae</uri>
55                     </mesh>

```

```
51                                     </geometry>
52                               </visual>
53                         </link>
54                   </model>
55 </sdf>
```

180 `models/bsmallkknife/model.config`

```
1  <?xml version="1.0"?>
2
3  <model>
4    <name>b_small_knife</name>
5    <version>1.0</version>
6    <sdf version="1.6">model.sdf</sdf>
7
8    <author>
9      <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10     <email>bryanwang1992@outlook.com</email>
11   </author>
12
13   <description>
14     b_small_blue_knife
15   </description>
16
17 </model>
```

181 models/b_spatula/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3      <model name='b_spatula'>
4          <static>false</static>
5          <pose>0 0 0 0 0 0</pose>
6
7          <link name='link'>
8              <inertial>
9                  <mass>0.11</mass>
10                 <pose>0.00088072 -6.5132e-05 0.00086388 0 0 0</pose>
11                 <inertia>
12                     <ixx>8.1404e-07</ixx>
13                     <ixy>0</ixy>
14                     <ixz>0</ixz>
15                     <iyy>1.1521e-06</iyy>
16                     <iyz>0</iyz>
17                     <izz>5.3661e-07</izz>
18                 </inertia>
19             </inertial>
20
21             <sensor name="tool_contact_sensor" type="contact">
22                 <always_on>true</always_on>
23                 <update_rate>30.0</update_rate>
24                 <contact>
25                     <collision>collision</collision>
26                 </contact>
27                 <plugin name="tool_bumper" filename="
28                     libgazebo_ros_bumper.so">
29                     <bumperTopicName>
30                         tool_contact_sensor_state</
31                         bumperTopicName>
32                     <frameName>world</frameName>
33                 </plugin>
34             </sensor>
35
36             <collision name='collision'>
37                 <geometry>
38                     <mesh>
39                         <uri>model://b_spatula/b_spatula
40                             .dae</uri>
41                     </mesh>
42                 </geometry>
43                 <surface>
44                     <friction>
45                         <ode>
46                             <mu>0.2</mu>
47                             <mu2>0.2</mu2>
48                         </ode>
49                     </friction>
50                 </surface>
51             </collision>
52
53             <visual name='visual'>
54                 <geometry>
55                     <mesh>
56                         <uri>model://b_spatula/b_spatula

```

```

52                                     </mesh> .dae</uri>
53                               </geometry>
54       </visual>
55   </link>
56 </model>
57 </sdf>

```

182 models/b_spatula/model.config

```
1 <?xml version="1.0"?>
2
3 <model>
4   <name>b_spatula</name>
5   <version>1.0</version>
6   <sdf version="1.6">model.sdf</sdf>
7
8   <author>
9     <name>Frank Guerin, Pawel Gajewski, Paulo A. Ferreira and Wang Chaozheng</
      name>
10    <email>bryanwang1992@outlook.com</email>
11  </author>
12
13  <description>
14    b_spatula
15  </description>
16
17 </model>
```

183 models/b_frying_pan/model.sdf

```

1  <?xml version='1.0'?>
2  <sdf version='1.6'>
3    <model name='b_frying_pan'>
4      <static>false</static>
5      <pose>0 0 0 0 0 0</pose>
6
7      <link name='link'>
8        <inertial>
9          <mass>1</mass>
10         <pose>0.002625 0.0 0.01465 0 0 0</pose>
11         <inertia>
12           <ixx>0.007971675</ixx>
13           <iyy>0.008713309</iyy>
14           <izz>0.016311566</izz>
15           <ixy>-1.69694542e-019</ixy>
16           <ixz>-0.000025788</ixz>
17           <iyz>-6.28650663e-021</iyz>
18         </inertia>
19       </inertial>t
20
21       <collision name='collision'>
22         <geometry>
23           <mesh>
24             <uri>model://b_frying_pan/b_frying_pan.dae</uri>
25           </mesh>
26         </geometry>
27         <surface>
28           <friction>
29             <ode>
30               <mu>0.2</mu>
31               <mu2>0.2</mu2>
32             </ode>
33           </friction>
34         </surface>
35       </collision>
36       <visual name='visual'>
37         <geometry>
38           <mesh>
39             <uri>model://b_frying_pan/b_frying_pan.dae</uri>
40           </mesh>
41         </geometry>
42       </visual>
43     </link>
44   </model>
45 </sdf>

```


184 models/b_{frying}_{pan}/model.config

```
1 <?xml version="1.0"?>
2
3 <model>
4   <name>b_frying_pan</name>
5   <version>1.0</version>
6   <sdf version='1.6'>model.sdf</sdf>
7
8   <author>
9     <name>Pawel Gajewski</name>
10    <email>pawel.gajewski@agh.edu.pl</email>
11  </author>
12
13  <description>
14    IAI lab frying pan.
15  </description>
16 </model>
```

185 `initial_poses/pr2_scrapping.yaml`

```
1 simulated_joints:
2   - head_pan_joint
3   - head_tilt_joint
4   - torso_lift_joint
5   - l_elbow_flex_joint
6   - l_forearm_roll_joint
7   - l_shoulder_lift_joint
8   - l_shoulder_pan_joint
9   - l_upper_arm_roll_joint
10  - l_wrist_flex_joint
11  - l_wrist_roll_joint
12  - r_elbow_flex_joint
13  - r_forearm_roll_joint
14  - r_shoulder_lift_joint
15  - r_shoulder_pan_joint
16  - r_upper_arm_roll_joint
17  - r_wrist_flex_joint
18  - r_wrist_roll_joint
19  - laser_tilt_mount_joint
20  - r_gripper_l_finger_joint
21  - r_gripper_r_finger_joint
22  - l_gripper_l_finger_joint
23  - l_gripper_r_finger_joint
24  - l_gripper_l_finger_tip_joint
25  - l_gripper_r_finger_tip_joint
26  - r_gripper_l_finger_tip_joint
27  - r_gripper_r_finger_tip_joint
28  - l_gripper_joint
29  - r_gripper_joint
30  - l_gripper_motor_screw_joint
31  - r_gripper_motor_screw_joint
32  - r_gripper_motor_slider_joint
33  - l_gripper_motor_slider_joint
34  - fl_caster_l_wheel_joint
35  - fl_caster_r_wheel_joint
36  - fr_caster_l_wheel_joint
37  - fr_caster_r_wheel_joint
38  - bl_caster_l_wheel_joint
39  - bl_caster_r_wheel_joint
40  - br_caster_l_wheel_joint
41  - br_caster_r_wheel_joint
42  - fl_caster_rotation_joint
43  - fr_caster_rotation_joint
44  - bl_caster_rotation_joint
45  - br_caster_rotation_joint
46  - torso_lift_motor_screw_joint
47
48 controlled_joints:
49   - head_pan_joint
50   - head_tilt_joint
51   - torso_lift_joint
52   - l_elbow_flex_joint
53   - l_forearm_roll_joint
54   - l_shoulder_lift_joint
55   - l_shoulder_pan_joint
```

```

56 - l_upper_arm_roll_joint
57 - l_wrist_flex_joint
58 - l_wrist_roll_joint
59 - r_elbow_flex_joint
60 - r_forearm_roll_joint
61 - r_shoulder_lift_joint
62 - r_shoulder_pan_joint
63 - r_upper_arm_roll_joint
64 - r_wrist_flex_joint
65 - r_wrist_roll_joint
66 - r_gripper_l_finger_joint
67 - r_gripper_r_finger_joint
68 - l_gripper_l_finger_joint
69 - l_gripper_r_finger_joint
70 start_config:
71   torso_lift_joint: 0.3007849430842053
72   head_pan_joint: -0.016552842705291115
73   head_tilt_joint: 0.7287556667322448
74   r_upper_arm_roll_joint: -1.3351230294970737
75   r_shoulder_pan_joint: -1.0489713192626062
76   r_shoulder_lift_joint: -0.0337662888586017
77   r_forearm_roll_joint: 4.954040580711836
78   r_elbow_flex_joint: -1.6954641064176876
79   r_wrist_flex_joint: -1.5742733400117634
80   r_wrist_roll_joint: -2.398480044745123
81   l_elbow_flex_joint: -1.1000206816083982
82   l_forearm_roll_joint: 0.8018847264145844
83   l_shoulder_lift_joint: 0.09913986734189655
84   l_shoulder_pan_joint: 0.5244532801685695
85   l_upper_arm_roll_joint: 0.5151343804663929
86   l_wrist_flex_joint: -0.6394288886084176
87   l_wrist_roll_joint: 6.7505988913485035
88 projection_mode: false
89 sim_frequency: 100
90 watchdog_period: 0.1

```

186 `initial_poses/naive_kinematics_sim.yaml`

```

1  simulated_joints:
2    - head_pan_joint
3    - head_tilt_joint
4    - torso_lift_joint
5    - l_elbow_flex_joint
6    - l_forearm_roll_joint
7    - l_shoulder_lift_joint
8    - l_shoulder_pan_joint
9    - l_upper_arm_roll_joint
10   - l_wrist_flex_joint
11   - l_wrist_roll_joint
12   - r_elbow_flex_joint
13   - r_forearm_roll_joint
14   - r_shoulder_lift_joint
15   - r_shoulder_pan_joint
16   - r_upper_arm_roll_joint
17   - r_wrist_flex_joint
18   - r_wrist_roll_joint
19   - laser_tilt_mount_joint
20   - r_gripper_l_finger_joint
21   - r_gripper_r_finger_joint
22   - l_gripper_l_finger_joint
23   - l_gripper_r_finger_joint
24   - l_gripper_l_finger_tip_joint
25   - l_gripper_r_finger_tip_joint
26   - r_gripper_l_finger_tip_joint
27   - r_gripper_r_finger_tip_joint
28   - l_gripper_joint
29   - r_gripper_joint
30   - l_gripper_motor_screw_joint
31   - r_gripper_motor_screw_joint
32   - r_gripper_motor_slider_joint
33   - l_gripper_motor_slider_joint
34   - fl_caster_l_wheel_joint
35   - fl_caster_r_wheel_joint
36   - fr_caster_l_wheel_joint
37   - fr_caster_r_wheel_joint
38   - bl_caster_l_wheel_joint
39   - bl_caster_r_wheel_joint
40   - br_caster_l_wheel_joint
41   - br_caster_r_wheel_joint
42   - fl_caster_rotation_joint
43   - fr_caster_rotation_joint
44   - bl_caster_rotation_joint
45   - br_caster_rotation_joint
46   - torso_lift_motor_screw_joint
47
48  controlled_joints:
49    - head_pan_joint
50    - head_tilt_joint
51    - torso_lift_joint
52    - l_elbow_flex_joint
53    - l_forearm_roll_joint
54    - l_shoulder_lift_joint
55    - l_shoulder_pan_joint

```

```

56 - l_upper_arm_roll_joint
57 - l_wrist_flex_joint
58 - l_wrist_roll_joint
59 - r_elbow_flex_joint
60 - r_forearm_roll_joint
61 - r_shoulder_lift_joint
62 - r_shoulder_pan_joint
63 - r_upper_arm_roll_joint
64 - r_wrist_flex_joint
65 - r_wrist_roll_joint
66 - r_gripper_l_finger_joint
67 - r_gripper_r_finger_joint
68 - l_gripper_l_finger_joint
69 - l_gripper_r_finger_joint
70 start_config:
71   torso_lift_joint: 0.3000262665739086
72   head_pan_joint: -0.016552842705291115
73   head_tilt_joint: 0.7287556667322448
74   r_upper_arm_roll_joint: -0.9545442485020886
75   r_shoulder_pan_joint: -0.9763766874612734
76   r_shoulder_lift_joint: 0.5734009433853502
77   r_forearm_roll_joint: 5.26860285279
78   r_elbow_flex_joint: -1.6422521567729969
79   r_wrist_flex_joint: -1.5074640847105494
80   r_wrist_roll_joint: 1.90604009753
81   l_elbow_flex_joint: -1.00213547438
82   l_forearm_roll_joint: 0.834058592757
83   l_shoulder_lift_joint: 0.103903217692
84   l_shoulder_pan_joint: 0.3688738798
85   l_upper_arm_roll_joint: 0.730572260662
86   l_wrist_flex_joint: -1.34841376457
87   l_wrist_roll_joint: 7.00870758722
88 projection_mode: false
89 sim_frequency: 100
90 watchdog_period: 0.1

```

187 CMakeLists.txt

```
1  cmake_minimum_required(VERSION 2.8.3)
2  project(skill_transfer)
3
4  ## Compile as C++11, supported in ROS Kinetic and newer
5  add_compile_options(-std=c++11)
6
7  ## Find catkin dependencies
8  find_package(catkin REQUIRED COMPONENTS
9    roscpp
10   actionlib
11   message_generation
12   giskard_core
13   giskard_ros_utils
14   kdl_conversions
15   std_msgs
16   gazebo_msgs
17   gazebo_ros
18   sensor_msgs
19 )
20
21 ## Find Boost
22 find_package(Boost REQUIRED COMPONENTS
23   system
24   filesystem
25 )
26
27 # Depend on system install of Gazebo
28 find_package(gazebo REQUIRED)
29
30 # YAML library
31 find_library(YAML_CPP_LIBRARIES yaml-cpp)
32 if(NOT YAML_CPP_LIBRARIES)
33   # If yaml-cpp not found in the system, try finding it as a user CMake-
34   # generated project
35   find_package(yaml-cpp REQUIRED)
36   include_directories(${YAML_CPP_INCLUDE_DIRS})
37 endif(NOT YAML_CPP_LIBRARIES)
38
39 ## Add actions
40 add_action_files(DIRECTORY action FILES
41   MoveArm.action
42 )
43
44 ## Add messages
45 add_message_files(
46   FILES
47   StopCondition.msg
48 )
49
50 add_service_files(
51   FILES
52   DetectTargetObjectInfo.srv
53   DetectToolInfo.srv
54   GetTaskSpec.srv
```

```

55     GetMotionSpec.srv
56 )
57
58 ## Generate messages
59 generate_messages(
60     DEPENDENCIES
61     std_msgs
62     actionlib_msgs
63     geometry_msgs
64     sensor_msgs
65 )
66
67 ## Define catkin exports
68 catkin_package(
69     CATKIN_DEPENDS message_runtime roscpp actionlib
70     DEPENDS Boost gazebo_ros
71 )
72
73 ## Setup link dirs
74 link_directories(
75     ${GAZEBO_LIBRARY_DIRS}
76 )
77
78 ## Setup include dirs
79 include_directories(
80     include
81     ${catkin_INCLUDE_DIRS}
82     ${Boost_INCLUDE_DIRS}
83     ${GAZEBO_INCLUDE_DIRS}
84     ${YAML_CPP_INCLUDE_DIRS}
85 )
86
87 ## Constraint controller for PR2 pr2
88 add_executable(constraint_controller_pr2
89     src/constraint_controller_pr2.cpp
90     src/giskard_adapter.cpp
91 )
92 target_link_libraries(constraint_controller_pr2 ${catkin_LIBRARIES})
93 add_dependencies(constraint_controller_pr2 ${${PROJECT_NAME}_EXPORTED_TARGETS} ${
94     {catkin_EXPORTED_TARGETS}}
95
96 ## Constraint controller for gazebo free_ees
97 add_executable(constraint_controller_free_ees
98     src/constraint_controller_free_ees.cpp
99     src/giskard_adapter.cpp
100 )
101 target_link_libraries(constraint_controller_free_ees ${catkin_LIBRARIES})
102 add_dependencies(constraint_controller_free_ees ${${PROJECT_NAME}
103     _EXPORTED_TARGETS} ${catkin_EXPORTED_TARGETS})
104
105 ## Task executive
106 add_executable(task_executive
107     src/task_executive.cpp
108     src/twist_log.cpp
109 )
110 target_link_libraries(task_executive ${catkin_LIBRARIES})
111 add_dependencies(task_executive ${${PROJECT_NAME}_EXPORTED_TARGETS} ${

```

```

        catkin_EXPORTED_TARGETS}))
110
111 ## Knowledge manager
112 add_executable(knowledge_manager
113     src/knowledge_manager.cpp
114 )
115 target_link_libraries(knowledge_manager ${catkin_LIBRARIES} ${YAML_CPP_LIBRARIES}
116 )
117 add_dependencies(knowledge_manager ${${PROJECT_NAME}_EXPORTED_TARGETS} ${
118     catkin_EXPORTED_TARGETS})
119
120 ## Feature detector
121 add_executable(feature_detector
122     src/feature_detector.cpp
123 )
124 target_link_libraries(feature_detector ${catkin_LIBRARIES})
125 add_dependencies(feature_detector ${${PROJECT_NAME}_EXPORTED_TARGETS} ${
126     catkin_EXPORTED_TARGETS})
127
128 # Gazebo Plugins
129
130 ## Force controller plugin
131 add_library(velocity_controller_plugin plugins/velocity_controller_plugin.cpp)
132 target_link_libraries(velocity_controller_plugin ${catkin_LIBRARIES} ${
133     GAZEBO_LIBRARIES})
134
135 ## Force controller plugin
136 add_library(position_controller_plugin plugins/position_controller_plugin.cpp)
137 target_link_libraries(position_controller_plugin ${catkin_LIBRARIES} ${
138     GAZEBO_LIBRARIES})
139
140 ## TF broadcaster plugin
141 add_library(tf_broadcaster_plugin plugins/tf_broadcaster_plugin.cpp)
142 target_link_libraries(tf_broadcaster_plugin ${catkin_LIBRARIES} ${
143     GAZEBO_LIBRARIES})
144
145 ## Feature visualization plugin
146 add_library(giskard_visualization_plugin plugins/giskard_visualization_plugin.
147     cpp)
148 target_link_libraries(giskard_visualization_plugin ${catkin_LIBRARIES} ${
149     GAZEBO_LIBRARIES})
150
151 ## Grip plugin
152 add_library(GripPlugin plugins/GripPlugin.cc)
153 target_link_libraries(GripPlugin ${catkin_LIBRARIES} ${GAZEBO_LIBRARIES})
154
155 ## Stick plugin
156 add_library(StickPlugin plugins/StickPlugin.cc)
157 target_link_libraries(StickPlugin ${catkin_LIBRARIES} ${GAZEBO_LIBRARIES})
158
159 ## book_grasp plugin
160 add_library(TiltGrabPlugin plugins/TiltGrabPlugin.cc)
161 target_link_libraries(TiltGrabPlugin ${catkin_LIBRARIES} ${GAZEBO_LIBRARIES})
162
163 ## other_book_grasp plugin
164 add_library(OtherGraspPlugin plugins/OtherGraspPlugin.cc)
165 target_link_libraries(OtherGraspPlugin ${catkin_LIBRARIES} ${GAZEBO_LIBRARIES})

```



```

158
159 ## Grip plugin
160 add_library(GrainsFactoryPlugin plugins/GrainsFactoryPlugin.cc)
161 target_link_libraries(GrainsFactoryPlugin ${catkin_LIBRARIES} ${GAZEBO_LIBRARIES}
    })
162
163 ## Grip plugin
164 add_library(LasagnaFactoryPlugin plugins/LasagnaFactoryPlugin.cc)
165 target_link_libraries(LasagnaFactoryPlugin ${catkin_LIBRARIES} ${
    GAZEBO_LIBRARIES})
166
167 ## Controller visualization Gazebo plugin
168 #add_library(controller_visualization_plugin src/controller_visualization_plugin
    .cpp)
169 #target_link_libraries(controller_visualization_plugin ${catkin_LIBRARIES} ${
    GAZEBO_LIBRARIES})
170
171 ## Install scripts and executables
172 # install(PROGRAMS
173 #     scripts/gen_numbers.py
174 #     DESTINATION ${CATKIN_PACKAGE_BIN_DESTINATION})
175
176 # install(TARGETS averaging_server averaging_client
177 #     ARCHIVE DESTINATION ${CATKIN_PACKAGE_LIB_DESTINATION}
178 #     LIBRARY DESTINATION ${CATKIN_PACKAGE_LIB_DESTINATION}
179 #     RUNTIME DESTINATION ${CATKIN_PACKAGE_BIN_DESTINATION})

```

188 worlds/scraping_{bw}ild_oowl_{bt}able_kknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_wildo_bowl_b_table_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_table_knife</uri>
15       <pose>0.060878 0.497562 1.005864 1.616805 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.135713 0.488941 1.003983 0.274231 1.507716 1.875637</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_table_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_wildo_bowl</uri>
30       <pose>0.078818 -0.501749 0.988186 3.097035 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_table_knife::link</childLinkName>
59         <relativePose>0.060878 -0.002438 0.005864 1.6168 0 0</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
63         so">
64         <linkName>link</linkName>
65         <frameName>l_gripper_tool_frame</frameName>
66     </plugin>
67 </include>
68
69 <!-- Right Gripper -->
70 <include>
71     <uri>model://gripper</uri>
72     <name>right_ee</name>
73     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
74
75     <plugin name="r_force_controller" filename="
76         libvelocity_controller_plugin.so">
77         <linkName>link</linkName>
78         <topicName>set_r_ee_twist</topicName>
79         <gains>
80             <linear>
81                 <P>100.0</P>
82                 <I>0.0</I>
83                 <D>25.0</D>
84             </linear>
85             <angular>
86                 <P>100.0</P>
87                 <I>0.0</I>
88                 <D>25.0</D>
89             </angular>
90         </gains>
91     </plugin>
92
93     <plugin name="r_grip" filename="libGripPlugin.so">
94         <parentLinkName>link</parentLinkName>
95         <childLinkName>b_wildo_bowl::link</childLinkName>
96         <relativePose>0.0089419 0.0135799 0.0780419 1.55636 1.32285
97             -1.41637</relativePose>
98     </plugin>
99
100     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
101         so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>
106
107 <plugin name="feature_visualization_plugin" filename="
108     libgiskard_visualization_plugin.so"></plugin>
109
110 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

189 worlds/freezer_{box}7.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30     <include>
31         <uri>model://finger</uri>
32         <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33     </include> -->
34
35     <include>
36         <uri>model://freezer_box</uri>
37         <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38     </include>
39
40
41
42     <model name='book_target'>
43         <static>false</static>
44         <pose>0.220000 0.000000 0.300000 1.570796 0.000000 0.000000</pose>
45
46     <link name='book_link'>
47         <pose frame='link'>0.0 0.0 0.0 0.0 0 0</pose>
48         <inertial>
49             <mass>0.1</mass>
50             <pose frame='link'>0.0 0.0 0.0 0 0 0</pose>
51             <inertia>
52                 <ixx>0.000666667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
53                 <ixy>0</ixy>
54                 <ixz>0</ixz>
55                 <iyy>0.000666667</iyy>

```

```

56         <iyz>0</iyz>
57         <izz>0.000666667</izz>
58     </inertia>
59 </inertial>
60 <collision name='book_collision'>
61     <geometry>
62         <box>
63             <size>0.2 0.2 0.2</size>
64         </box>
65     </geometry>
66     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
67 <surface>
68     <friction>
69         <ode>
70             <mu>0.2</mu>
71             <mu2>0.2</mu2>
72         </ode>
73     </friction>
74 </surface>
75 </collision>
76 <visual name='book_visual'>
77     <geometry>
78         <box>
79             <size>0.2 0.2 0.2</size>
80         </box>
81     </geometry>
82     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
83 </visual>
84 <sensor name="main_bumper" type="contact">
85     <selfCollide>true</selfCollide>
86     <alwaysOn>true</alwaysOn>
87     <updateRate>15.0</updateRate>
88     <contact>
89         <collision>book_collision</collision>
90     </contact>
91 </sensor>
92 </link>
93 <plugin name="target_tf_broadcaster" filename="
    libtf_broadcaster_plugin.so">
94     <linkName>book_link</linkName>
95     <frameName>book_object_frame</frameName>
96 </plugin>
97 <plugin name="grasp" filename="libTiltGrabPlugin.so">
98     <parentLinkName>book_link</parentLinkName>
99     <childLinkName1>left_ee::link</childLinkName1>
100    <childLinkName2>right_ee::link</childLinkName2>
101    <childLinkName3>right_ee_2::link</childLinkName3>
102    <sensorName>book_contact</sensorName>
103 </plugin>
104 </model>
105
106
107
108 <!-- Left Gripper -->
109 <include>
110     <uri>model://finger</uri>
111     <name>left_ee</name>

```

```

112     <pose>0.000000 0.000000 0.880000 0.000000 0.000000 1.57080</pose>
113
114
115     <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
116         <linkName>link</linkName>
117         <topicName>set_l_ee_twist</topicName>
118         <gains>
119             <linear>
120                 <P>100.0</P>
121                 <I>0.0</I>
122                 <D>25.0</D>
123             </linear>
124             <angular>
125                 <P>100.0</P>
126                 <I>0.0</I>
127                 <D>25.0</D>
128             </angular>
129         </gains>
130     </plugin>
131
132     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
133         <linkName>link</linkName>
134         <frameName>l_gripper_tool_frame</frameName>
135     </plugin>
136 </include>
137
138 <!-- Right Gripper -->
139 <include>
140     <uri>model://finger</uri>
141     <name>right_ee</name>
142     <pose>0.600000 0.500000 0.830000 0.000000 0.000000 1.57080</pose>
143
144     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
145         <linkName>link</linkName>
146         <topicName>set_r_ee_twist</topicName>
147         <gains>
148             <linear>
149                 <P>100.0</P>
150                 <I>0.0</I>
151                 <D>25.0</D>
152             </linear>
153             <angular>
154                 <P>100.0</P>
155                 <I>0.0</I>
156                 <D>25.0</D>
157             </angular>
158         </gains>
159     </plugin>
160
161     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
162         <linkName>link</linkName>
163         <frameName>r_gripper_tool_frame</frameName>
164     </plugin>

```

```

165     </include>
166
167     <include>
168         <uri>model://finger</uri>
169         <name>right_ee_2</name>
170         <pose>0.600000 -0.500000 0.830000 0.000000 0.000000 1.57080</pose>
171
172         <plugin name="r_2_force_controller" filename="
            libvelocity_controller_plugin.so">
173             <linkName>link</linkName>
174             <topicName>set_r_ee_2_twist</topicName>
175             <gains>
176                 <linear>
177                     <P>100.0</P>
178                     <I>0.0</I>
179                     <D>25.0</D>
180                 </linear>
181                 <angular>
182                     <P>100.0</P>
183                     <I>0.0</I>
184                     <D>25.0</D>
185                 </angular>
186             </gains>
187         </plugin>
188
189         <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
            .so">
190             <linkName>link</linkName>
191             <frameName>r_2_gripper_tool_frame</frameName>
192         </plugin>
193     </include>
194
195     <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
196
197     <gui>
198         <camera name='user_camera'>
199             <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
200             <view_controller>orbit</view_controller>
201         </camera>
202     </gui>
203
204 </world>
205 </sdf>

```


190 worlds/scraping_bfrying_pan_btable_kknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_frying_pan_b_table_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_table_knife</uri>
15       <pose>0.060878 0.497562 1.005864 1.616805 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.135713 0.488941 1.003983 0.274231 1.507716 1.875637</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_table_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_frying_pan</uri>
30       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://grripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_table_knife::link</childLinkName>
59         <relativePose>0.060878 -0.002438 0.005864 1.6168 0 0</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_frying_pan::link</childLinkName>
94         <relativePose>0.0186144 0.0468562 0.224672 -1.55141 -1.36676
            1.3834</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

191 worlds/scraping_{bp}ot_{bk}knife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_pot_b_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_knife</uri>
15       <pose>0.090993 0.503448 0.999041 -1.609842 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.200479 1.549194 2.743074</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_pot</uri>
30       <pose>0.133471 -0.503990 0.971217 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_knife::link</childLinkName>
59         <relativePose>0.090993 0.003448 -0.000959 -1.60984 0 0</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
            libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_pot::link</childLinkName>
94         <relativePose>0.023942 0.0237816 0.132364 -1.55141 -1.36676
            1.3834</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
            libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

192 worlds/grabbing_book4.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30         <include>
31             <uri>model://finger</uri>
32             <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33         </include> -->
34
35         <include>
36             <uri>model://bookshelf_</uri>
37             <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38         </include>
39
40         <!-- Books -->
41
42
43         <!--<include>
44             <uri>model://book</uri>
45             <name>book3</name>
46             <pose>0.150000 0.624000 0.475000 0.000000 0.000000 1.57080</pose>
47         </include> -->
48
49
50         <model name='book_target'>
51             <static>false</static>
52             <pose>0.150000 0.861000 0.585000 0.000000 0.000000 1.57080</pose>
53
54             <link name='book_link'>
55                 <pose frame='link'>0 0 0 0 0 0</pose>

```

```

56     <inertial>
57       <mass>0.1</mass>
58       <pose frame='link'>0 0 0 0 0 0</pose>
59       <inertia>
60         <ixx>0.000666667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
61         <ixy>0</ixy>
62         <ixz>0</ixz>
63         <iyy>0.000666667</iyy>
64         <iyz>0</iyz>
65         <izz>0.000666667</izz>
66       </inertia>
67     </inertial>
68     <collision name='book_collision'>
69       <geometry>
70         <box>
71           <size>0.2 0.2 0.2</size>
72         </box>
73       </geometry>
74       <pose frame=''>0 0 0 0 0 0</pose>
75       <surface>
76         <friction>
77           <ode>
78             <mu>0.2</mu>
79             <mu2>0.2</mu2>
80           </ode>
81         </friction>
82       </surface>
83     </collision>
84     <visual name='book_visual'>
85       <geometry>
86         <box>
87           <size>0.2 0.2 0.2</size>
88         </box>
89       </geometry>
90       <pose frame=''>0 0 0 0 0 0</pose>
91     </visual>
92     <sensor name="main_bumper" type="contact">
93       <selfCollide>true</selfCollide>
94       <alwaysOn>true</alwaysOn>
95       <updateRate>15.0</updateRate>
96       <contact>
97         <collision>book_collision</collision>
98       </contact>
99       <!--<plugin name="gazebo_ros_bumper_controller" filename="
100         libgazebo_ros_bumper.so">
101         <bumperTopicName>bumper_vals</bumperTopicName>
102         <frameName>book_target</frameName>
103       </plugin> -->
104     </sensor>
105   </link>
106   <plugin name="target_tf_broadcaster" filename="
107     libtf_broadcaster_plugin.so">
108     <linkName>book_link</linkName>
109     <frameName>book_object_frame</frameName>
110   </plugin>
111   <plugin name="grasp" filename="libTiltGrabPlugin.so">
112     <parentLinkName>book_link</parentLinkName>

```



```

111     <childLinkName1>left_ee::link</childLinkName1>
112     <childLinkName2>right_ee::link</childLinkName2>
113     <childLinkName3>right_ee_2::link</childLinkName3>
114     <sensorName>book_contact</sensorName>
115   </plugin>
116 </model>
117
118
119
120 <!-- Left Gripper -->
121 <include>
122   <uri>model://finger</uri>
123   <name>left_ee</name>
124   <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
125
126
127   <plugin name="l_force_controller" filename="
128     libvelocity_controller_plugin.so">
129     <linkName>link</linkName>
130     <topicName>set_l_ee_twist</topicName>
131     <gains>
132       <linear>
133         <P>100.0</P>
134         <I>0.0</I>
135         <D>25.0</D>
136       </linear>
137       <angular>
138         <P>100.0</P>
139         <I>0.0</I>
140         <D>25.0</D>
141       </angular>
142     </gains>
143   </plugin>
144
145   <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
146     so">
147     <linkName>link</linkName>
148     <frameName>l_gripper_tool_frame</frameName>
149   </plugin>
150 </include>
151
152 <!-- Right Gripper -->
153 <include>
154   <uri>model://finger</uri>
155   <name>right_ee</name>
156   <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
157
158
159   <plugin name="r_force_controller" filename="
160     libvelocity_controller_plugin.so">
161     <linkName>link</linkName>
162     <topicName>set_r_ee_twist</topicName>
163     <gains>
164       <linear>

```

```

165         <angular>
166             <P>100.0</P>
167             <I>0.0</I>
168             <D>25.0</D>
169         </angular>
170     </gains>
171 </plugin>
172
173     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
174         so">
175         <linkName>link</linkName>
176         <frameName>r_gripper_tool_frame</frameName>
177     </plugin>
178 </include>
179
180 <include>
181     <uri>model://finger</uri>
182     <name>right_ee_2</name>
183     <pose>1.150000 0.700000 0.475000 0.000000 0.000000 1.57080</pose>
184
185     <plugin name="r_2_force_controller" filename="
186         libvelocity_controller_plugin.so">
187         <linkName>link</linkName>
188         <topicName>set_r_ee_2_twist</topicName>
189         <gains>
190             <linear>
191                 <P>100.0</P>
192                 <I>0.0</I>
193                 <D>25.0</D>
194             </linear>
195             <angular>
196                 <P>100.0</P>
197                 <I>0.0</I>
198                 <D>25.0</D>
199             </angular>
200         </gains>
201     </plugin>
202
203     <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
204         .so">
205         <linkName>link</linkName>
206         <frameName>r_2_gripper_tool_frame</frameName>
207     </plugin>
208 </include>
209
210 <plugin name="feature_visualization_plugin" filename="
211     libgiskard_visualization_plugin.so"></plugin>
212
213 <gui>
214     <camera name='user_camera'>
215         <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
216         <view_controller>orbit</view_controller>
217     </camera>
218 </gui>
219
220 </world>
221 </sdf>

```

193 worlds/scraping_{bw}ildowl_{bs}patula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_wildo_bowl_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.461945 1.549196 2.743082</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_wildo_bowl</uri>
30       <pose>0.078818 -0.501749 0.988186 3.097035 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://grripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_spatula::link</childLinkName>
59         <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
        -3.14159</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_wildo_bowl::link</childLinkName>
94         <relativePose>0.0089419 0.0135799 0.0780419 1.55636 1.32285
        -1.41637</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

194 worlds/freezer_{box}3.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29 <!--
30         <include>
31             <uri>model://finger</uri>
32             <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33         </include> -->
34
35         <include>
36             <uri>model://freezer_box</uri>
37             <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38         </include>
39
40
41
42         <model name='book_target'>
43             <static>false</static>
44             <pose>0.220000 0.000000 0.300000 1.570796 0.000000 0.000000</pose>
45
46         <link name='book_link'>
47             <pose frame='link'>0.0 0.0 0.0 0.0 0 0</pose>
48             <inertial>
49                 <mass>0.1</mass>
50                 <pose frame='link'>0.0 0.0 0.0 0 0 0</pose>
51                 <inertia>
52                     <ixx>0.00416666</ixx><!-- 1/12 * m * (h^2 + d^2) -->
53                     <ixy>0</ixy>
54                     <ixz>0</ixz>
55                     <iyy>0.00416666</iyy>

```

```

56         <iyz>0</iyz>
57         <izz>0.00416666</izz>
58     </inertia>
59 </inertial>
60 <collision name='book_collision'>
61     <geometry>
62         <box>
63             <size>0.5 0.5 0.5</size>
64         </box>
65     </geometry>
66     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
67     <surface>
68         <friction>
69             <ode>
70                 <mu>0.2</mu>
71                 <mu2>0.2</mu2>
72             </ode>
73         </friction>
74     </surface>
75 </collision>
76 <visual name='book_visual'>
77     <geometry>
78         <box>
79             <size>0.5 0.5 0.5</size>
80         </box>
81     </geometry>
82     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
83 </visual>
84 <sensor name="main_bumper" type="contact">
85     <selfCollide>true</selfCollide>
86     <alwaysOn>true</alwaysOn>
87     <updateRate>15.0</updateRate>
88     <contact>
89         <collision>book_collision</collision>
90     </contact>
91 </sensor>
92 </link>
93 <plugin name="target_tf_broadcaster" filename="
    libtf_broadcaster_plugin.so">
94     <linkName>book_link</linkName>
95     <frameName>book_object_frame</frameName>
96 </plugin>
97 <plugin name="grasp" filename="libTiltGrabPlugin.so">
98     <parentLinkName>book_link</parentLinkName>
99     <childLinkName1>left_ee::link</childLinkName1>
100    <childLinkName2>right_ee::link</childLinkName2>
101    <childLinkName3>right_ee_2::link</childLinkName3>
102    <sensorName>book_contact</sensorName>
103 </plugin>
104 </model>
105
106
107
108 <!-- Left Gripper -->
109 <include>
110     <uri>model://finger</uri>
111     <name>left_ee</name>

```

```

112     <pose>0.000000 0.000000 0.880000 0.000000 0.000000 1.57080</pose>
113
114
115     <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
116         <linkName>link</linkName>
117         <topicName>set_l_ee_twist</topicName>
118         <gains>
119             <linear>
120                 <P>100.0</P>
121                 <I>0.0</I>
122                 <D>25.0</D>
123             </linear>
124             <angular>
125                 <P>100.0</P>
126                 <I>0.0</I>
127                 <D>25.0</D>
128             </angular>
129         </gains>
130     </plugin>
131
132     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
133         <linkName>link</linkName>
134         <frameName>l_gripper_tool_frame</frameName>
135     </plugin>
136 </include>
137
138 <!-- Right Gripper -->
139 <include>
140     <uri>model://finger</uri>
141     <name>right_ee</name>
142     <pose>0.600000 0.500000 0.830000 0.000000 0.000000 1.57080</pose>
143
144     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
145         <linkName>link</linkName>
146         <topicName>set_r_ee_twist</topicName>
147         <gains>
148             <linear>
149                 <P>100.0</P>
150                 <I>0.0</I>
151                 <D>25.0</D>
152             </linear>
153             <angular>
154                 <P>100.0</P>
155                 <I>0.0</I>
156                 <D>25.0</D>
157             </angular>
158         </gains>
159     </plugin>
160
161     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
162         <linkName>link</linkName>
163         <frameName>r_gripper_tool_frame</frameName>
164     </plugin>

```



```

165     </include>
166
167     <include>
168         <uri>model://finger</uri>
169         <name>right_ee_2</name>
170         <pose>0.600000 -0.500000 0.830000 0.000000 0.000000 1.57080</pose>
171
172         <plugin name="r_2_force_controller" filename="
            libvelocity_controller_plugin.so">
173             <linkName>link</linkName>
174             <topicName>set_r_ee_2_twist</topicName>
175             <gains>
176                 <linear>
177                     <P>100.0</P>
178                     <I>0.0</I>
179                     <D>25.0</D>
180                 </linear>
181                 <angular>
182                     <P>100.0</P>
183                     <I>0.0</I>
184                     <D>25.0</D>
185                 </angular>
186             </gains>
187         </plugin>
188
189         <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
            .so">
190             <linkName>link</linkName>
191             <frameName>r_2_gripper_tool_frame</frameName>
192         </plugin>
193     </include>
194
195     <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
196
197     <gui>
198         <camera name='user_camera'>
199             <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
200             <view_controller>orbit</view_controller>
201         </camera>
202     </gui>
203
204 </world>
205 </sdf>

```

195 worlds/scooping_{bb}ig_bowl_{bs}erving_sspoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="big_bowl_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.024164 -0.383989 0.959287 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_big_bowl</uri>
30       <pose>0.024164 -0.383989 0.959287 -0.017186 -0.000884 -0.101566</
31         pose>
32     </include>
33
34     <include>
35       <uri>model://table</uri>
36       <pose>0.021929 0.062805 -0.116833 0 0 -1.571974</pose>
37     </include>
38
39     <!-- Left Gripper -->
40     <include>
41       <uri>model://gripper</uri>
42       <name>left_ee</name>
43       <pose>0 0.5 1 0 0 0</pose>
44
45       <plugin name="l_force_controller" filename="
46         libvelocity_controller_plugin.so">
47         <linkName>link</linkName>
48         <topicName>set_l_ee_twist</topicName>
49         <gains>
50           <linear>
51             <P>100.0</P>
52             <I>0.0</I>
53             <D>25.0</D>
54           </linear>
55           <angular>

```

```

54         <P>100.0</P>
55         <I>0.0</I>
56         <D>25.0</D>
57     </angular>
58 </gains>
59 </plugin>
60
61 <plugin name="l_grip" filename="libGripPlugin.so">
62     <parentLinkName>link</parentLinkName>
63     <childLinkName>b_serving_spoon::link</childLinkName>
64     <relativePose>0.112571612 0.00813051871955 -0.0153673645109
        1.3828344221275815 0.015398730956486372 0.08077832485708741</
        relativePose>
65 </plugin>
66
67 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
68     <linkName>link</linkName>
69     <frameName>l_gripper_tool_frame</frameName>
70 </plugin>
71 </include>
72
73 <!-- Right Gripper -->
74 <include>
75     <uri>model://gripper</uri>
76     <name>right_ee</name>
77     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
78
79     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
80         <linkName>link</linkName>
81         <topicName>set_r_ee_twist</topicName>
82         <gains>
83             <linear>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </linear>
88             <angular>
89                 <P>100.0</P>
90                 <I>0.0</I>
91                 <D>25.0</D>
92             </angular>
93         </gains>
94     </plugin>
95
96     <plugin name="r_grip" filename="libGripPlugin.so">
97         <parentLinkName>link</parentLinkName>
98         <childLinkName>b_big_bowl::link</childLinkName>
99         <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
100     </plugin>
101
102     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
103         <linkName>link</linkName>
104         <frameName>r_gripper_tool_frame</frameName>
105     </plugin>

```

```
106     </include>
107
108     <plugin name="feature_visualization_plugin" filename="
109         libgiskard_visualization_plugin.so"></plugin>
110
111     <gui>
112         <camera name='user_camera'>
113             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
114             <view_controller>orbit</view_controller>
115         </camera>
116     </gui>
117 </world>
118 </sdf>
```

196 worlds/scooping_{bred_mug_{bs}erving_spoon_v}.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_red_mug_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.061612 -0.504614 1.006537 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_red_mug</uri>
30       <pose>0.061612 -0.504614 1.006537 0.423677 0 3.060068</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.066428 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43     <plugin name="l_force_controller" filename="
44       libvelocity_controller_plugin.so">
45       <linkName>link</linkName>
46       <topicName>set_l_ee_twist</topicName>
47       <gains>
48         <linear>
49           <P>100.0</P>
50           <I>0.0</I>
51           <D>25.0</D>
52         </linear>
53         <angular>
54           <P>100.0</P>
55           <I>0.0</I>

```

```

55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_serving_spoon::link</childLinkName>
63     <relativePose>0.112571612 0.00813051871955 -0.0153673645109
        1.3828344221275815 0.015398730956486372 0.08077832485708741</
        relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_red_mug::link</childLinkName>
98         <relativePose>-0.00780861 0.00428533 0.0614876 1.24173 -1.34456
        1.65836</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>

```

```

106
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116 </world>
117 </sdf>

```

197 worlds/scraping_bfrying_pan_bknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_frying_pan_b_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_knife</uri>
15       <pose>0.090993 0.503448 0.999041 -1.609842 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.200479 1.549194 2.743074</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_frying_pan</uri>
30       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```



```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_knife::link</childLinkName>
59         <relativePose>0.090993 0.003448 -0.000959 -1.60984 0 0</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
            libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_frying_pan::link</childLinkName>
94         <relativePose>0.0186144 0.0468562 0.224672 -1.55141 -1.36676
            1.3834</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
            libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

198 worlds/scraping_{br}ed_mug_{bt}able_kknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_red_mug_b_table_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_table_knife</uri>
15       <pose>0.060878 0.497562 1.005864 1.616805 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.135713 0.488941 1.003983 0.274231 1.507716 1.875637</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_table_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_red_mug</uri>
30       <pose>0.061612 -0.504614 1.006537 0.423677 0 3.060068</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_table_knife::link</childLinkName>
59         <relativePose>0.060878 -0.002438 0.005864 1.6168 0 0</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
63         so">
64         <linkName>link</linkName>
65         <frameName>l_gripper_tool_frame</frameName>
66     </plugin>
67 </include>
68
69 <!-- Right Gripper -->
70 <include>
71     <uri>model://gripper</uri>
72     <name>right_ee</name>
73     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
74
75     <plugin name="r_force_controller" filename="
76         libvelocity_controller_plugin.so">
77         <linkName>link</linkName>
78         <topicName>set_r_ee_twist</topicName>
79         <gains>
80             <linear>
81                 <P>100.0</P>
82                 <I>0.0</I>
83                 <D>25.0</D>
84             </linear>
85             <angular>
86                 <P>100.0</P>
87                 <I>0.0</I>
88                 <D>25.0</D>
89             </angular>
90         </gains>
91     </plugin>
92
93     <plugin name="r_grip" filename="libGripPlugin.so">
94         <parentLinkName>link</parentLinkName>
95         <childLinkName>b_red_mug::link</childLinkName>
96         <relativePose>-0.00780861 0.00428533 0.0614876 1.24173 -1.34456
97             1.65836</relativePose>
98     </plugin>
99
100     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
101         so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>
106
107 <plugin name="feature_visualization_plugin" filename="
108     libgiskard_visualization_plugin.so"></plugin>
109
110 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

199 worlds/scraping_bfrying_pan_achineseknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="scraping_b_frying_pan_a_chineseknife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://a_chineseknife</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.204097 0.507730 0.981312 2.803252 1.368166 </pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>a_chineseknife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_frying_pan</uri>
30       <pose>0.024164 -0.383989 0.959287 -0.008482 0.014974 1.005299</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>a_chineseknife::link</childLinkName>
59         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
            1.3828344221275815 0.015398730956486372 0.08077832485708741</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>-0.090855 -0.578006 0.994380 1.547371 1.402340 1.343701</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_frying_pan::link</childLinkName>
94         <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```


200 worlds/scraping_{bc}of_{fee}cup_{serving}spoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_coffee_cup_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.198795 0.509112 0.981783 3.036336 1.368174 -1.866245</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_serving_spoon::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_coffee_cup</uri>
30       <pose>-0.016492 -0.468631 0.965206 2.603069 -1.513021 -2.66073</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_serving_spoon::link</childLinkName>
59         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
            1.3828344221275815 0.015398730956486372 0.08077832485708741</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_coffee_cup::link</childLinkName>
94         <relativePose>0.0284501 0.0346428 -0.0213798 2.93848 0.00496188
            2.88401</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>

```

```
104
105     <gui>
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

201 worlds/corner_{box}.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="big_bowl_spatula_v">
4
5      <!-- <physics type="ode">
6        <max_step_size>0.001</max_step_size>
7        <real_time_factor>1</real_time_factor>
8        <real_time_update_rate>1000</real_time_update_rate>
9        <bullet>
10         <solver>
11           <iters>70</iters>
12         </solver>
13       </bullet>
14       <ode>
15         <solver>
16           <iters>70</iters>
17         </solver>
18       </ode>
19     </physics> -->
20
21     <include>
22       <uri>model://sun</uri>
23     </include>
24
25     <include>
26       <uri>model://ground_plane</uri>
27     </include>
28
29
30     <include>
31       <uri>model://bookshelf_</uri>
32       <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
33     </include>
34
35
36     <include>
37       <uri>model://book</uri>
38       <name>book_target</name>
39       <pose>0.150000 0.661000 0.475000 0.000000 0.000000 1.57080</pose>
40
41       <plugin name="target_tf_broadcaster" filename="
42         libtf_broadcaster_plugin.so">
43         <linkName>link</linkName>
44         <frameName>book_object_frame</frameName>
45       </plugin>
46     </include>
47
48
49     <!-- Left Gripper -->
50     <include>
51       <uri>model://finger</uri>
52       <name>left_ee</name>
53       <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
54

```

```

55
56     <plugin name="l_force_controller" filename="
      libvelocity_controller_plugin.so">
57         <linkName>link</linkName>
58         <topicName>set_l_ee_twist</topicName>
59         <gains>
60             <linear>
61                 <P>100.0</P>
62                 <I>0.0</I>
63                 <D>25.0</D>
64             </linear>
65             <angular>
66                 <P>100.0</P>
67                 <I>0.0</I>
68                 <D>25.0</D>
69             </angular>
70         </gains>
71     </plugin>
72
73     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
      so">
74         <linkName>link</linkName>
75         <frameName>l_gripper_tool_frame</frameName>
76     </plugin>
77 </include>
78
79 <!-- Right Gripper -->
80 <include>
81     <uri>model://finger</uri>
82     <name>right_ee</name>
83     <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
84
85     <plugin name="r_force_controller" filename="
      libvelocity_controller_plugin.so">
86         <linkName>link</linkName>
87         <topicName>set_r_ee_twist</topicName>
88         <gains>
89             <linear>
90                 <P>100.0</P>
91                 <I>0.0</I>
92                 <D>25.0</D>
93             </linear>
94             <angular>
95                 <P>100.0</P>
96                 <I>0.0</I>
97                 <D>25.0</D>
98             </angular>
99         </gains>
100     </plugin>
101
102     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
      so">
103         <linkName>link</linkName>
104         <frameName>r_gripper_tool_frame</frameName>
105     </plugin>
106 </include>
107

```

```

108     <include>
109         <uri>model://finger</uri>
110         <name>right_ee_2</name>
111         <pose>1.150000 0.7000000 0.475000 0.000000 0.000000 1.57080</pose>
112
113         <plugin name="r_2_force_controller" filename="
114             libvelocity_controller_plugin.so">
115             <linkName>link</linkName>
116             <topicName>set_r_ee_2_twist</topicName>
117             <gains>
118                 <linear>
119                     <P>100.0</P>
120                     <I>0.0</I>
121                     <D>25.0</D>
122                 </linear>
123                 <angular>
124                     <P>100.0</P>
125                     <I>0.0</I>
126                     <D>25.0</D>
127                 </angular>
128             </gains>
129         </plugin>
130
131         <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
132             .so">
133             <linkName>link</linkName>
134             <frameName>r_2_gripper_tool_frame</frameName>
135         </plugin>
136     </include>
137
138     <plugin name="feature_visualization_plugin" filename="
139         libgiskard_visualization_plugin.so"></plugin>
140
141     <gui>
142         <camera name='user_camera'>
143             <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
144             <view_controller>orbit</view_controller>
145         </camera>
146     </gui>
147
148 </world>
149 </sdf>

```

202 worlds/scooping_{bb}ig_bowl_{bs}patula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="big_bowl_spatula_v">
4
5      <!-- <physics type="ode">
6        <max_step_size>0.001</max_step_size>
7        <real_time_factor>1</real_time_factor>
8        <real_time_update_rate>1000</real_time_update_rate>
9        <bullet>
10         <solver>
11           <iters>70</iters>
12         </solver>
13       </bullet>
14       <ode>
15         <solver>
16           <iters>70</iters>
17         </solver>
18       </ode>
19     </physics> -->
20
21     <include>
22       <uri>model://sun</uri>
23     </include>
24
25     <include>
26       <uri>model://ground_plane</uri>
27     </include>
28
29     <include>
30       <uri>model://b_spatula</uri>
31       <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
32     </include>
33
34     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
35       <pose>0.024164 -0.383989 0.959287 0 0 0</pose>
36       <mass>0.001</mass>
37       <radius>0.015</radius>
38       <quantity>100</quantity>
39       <friction>0.4</friction>
40       <friction2>0.4</friction2>
41       <velocity_decay>0.3</velocity_decay>
42     </plugin>
43
44     <include>
45       <uri>model://b_big_bowl</uri>
46       <pose>0.024164 -0.383989 0.959287 -0.017186 -0.000884 -0.101566</
pose>
47     </include>
48
49     <include>
50       <uri>model://table</uri>
51       <pose>0.021929 0.062805 -0.116833 0 0 -1.571974</pose>
52     </include>
53
54     <!-- Left Gripper -->

```

```

55 <include>
56   <uri>model://gripper</uri>
57   <name>left_ee</name>
58   <pose>0 0.5 1 0 0 0</pose>
59
60   <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
61     <linkName>link</linkName>
62     <topicName>set_l_ee_twist</topicName>
63     <gains>
64       <linear>
65         <P>0.1</P>
66         <I>0.0</I>
67         <D>0.02</D>
68       </linear>
69       <angular>
70         <P>0.0001</P>
71         <I>0.0</I>
72         <D>0.000002</D>
73       </angular>
74     </gains>
75   </plugin>
76
77   <plugin name="l_grip" filename="libGripPlugin.so">
78     <parentLinkName>link</parentLinkName>
79     <childLinkName>b_spatula::link</childLinkName>
80     <relativePose>0.14 0.028 -0.002 -1.57 3.20 0.20</relativePose>
81   </plugin>
82
83   <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
84     <linkName>link</linkName>
85     <frameName>l_gripper_tool_frame</frameName>
86   </plugin>
87 </include>
88
89 <!-- Right Gripper -->
90 <include>
91   <uri>model://gripper</uri>
92   <name>right_ee</name>
93   <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
94
95   <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
96     <linkName>link</linkName>
97     <topicName>set_r_ee_twist</topicName>
98     <gains>
99       <linear>
100         <P>0.1</P>
101         <I>0.0</I>
102         <D>0.02</D>
103       </linear>
104       <angular>
105         <P>0.1</P>
106         <I>0.0</I>
107         <D>0.002</D>
108       </angular>

```



```

109         </gains>
110     </plugin>
111
112     <plugin name="r_grip" filename="libGripPlugin.so">
113         <parentLinkName>link</parentLinkName>
114         <childLinkName>b_big_bowl::link</childLinkName>
115         <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
116     </plugin>
117
118     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
119         so">
120         <linkName>link</linkName>
121         <frameName>r_gripper_tool_frame</frameName>
122     </plugin>
123 </include>
124
125 <plugin name="feature_visualization_plugin" filename="
126     libgiskard_visualization_plugin.so"></plugin>
127
128 <gui>
129     <camera name='user_camera'>
130         <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
131         <view_controller>orbit</view_controller>
132     </camera>
133 </gui>
134 </world>
</sdf>

```

203 worlds/scooping_{bc}of_{fee}c_{up}b_serving_sspoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_coffee_cup_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>-0.016492 -0.468631 0.965206 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_coffee_cup</uri>
30       <pose>-0.016492 -0.468631 0.965206 2.603069 -1.513021 -2.66073</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.085745 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43       <plugin name="l_force_controller" filename="
44         libvelocity_controller_plugin.so">
45         <linkName>link</linkName>
46         <topicName>set_l_ee_twist</topicName>
47         <gains>
48           <linear>
49             <P>100.0</P>
50             <I>0.0</I>
51             <D>25.0</D>
52           </linear>
53           <angular>

```

```

54         <I>0.0</I>
55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_serving_spoon::link</childLinkName>
63     <relativePose>0.112571612 0.00813051871955 -0.0153673645109
        1.3828344221275815 0.015398730956486372 0.08077832485708741</
        relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_coffee_cup::link</childLinkName>
98         <relativePose>0.0284501 0.0346428 -0.0213798 2.93848 0.00496188
            2.88401</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>

```

```
105     </include>
106
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116 </world>
117 </sdf>
```

204 worlds/scraping_{bp}ot_{bt}hin_spatula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_pot_b_thin_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_thin_spatula</uri>
15       <pose>0.094321 0.507657 1.009274 -1.637236 0.074980 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.218391 0.495434 1.018867 1.118105 1.524620 2.552731</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_thin_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_pot</uri>
30       <pose>0.133471 -0.503990 0.971217 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_thin_spatula::link</childLinkName>
59         <relativePose>0.094321 0.007657 0.009274 -1.63724 0.07498
        -3.14159</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_pot::link</childLinkName>
94         <relativePose>0.023942 0.0237816 0.132364 -1.55141 -1.36676
        1.3834</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

205 worlds/scraping_{bw}ild_oowl_bk_nife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_wildo_bowl_b_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_knife</uri>
15       <pose>0.090993 0.503448 0.999041 -1.609842 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.200479 1.549194 2.743074</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_wildo_bowl</uri>
30       <pose>0.078818 -0.501749 0.988186 3.097035 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```



```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_knife::link</childLinkName>
59         <relativePose>0.090993 0.003448 -0.000959 -1.60984 0 0</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
            libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_wildo_bowl::link</childLinkName>
94         <relativePose>0.0089419 0.0135799 0.0780419 1.55636 1.32285
            -1.41637</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
            libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

206 worlds/scooping_{bp}ot_{bs}erving_spoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_pot_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.133471 -0.503990 0.971217 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_pot</uri>
30       <pose>0.133471 -0.503990 0.971217 0 0 0</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.079240 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43     <plugin name="l_force_controller" filename="
44       libvelocity_controller_plugin.so">
45       <linkName>link</linkName>
46       <topicName>set_l_ee_twist</topicName>
47       <gains>
48         <linear>
49           <P>100.0</P>
50           <I>0.0</I>
51           <D>25.0</D>
52         </linear>
53         <angular>
54           <P>100.0</P>
55           <I>0.0</I>

```

```

55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_serving_spoon::link</childLinkName>
63     <relativePose>0.112571612 0.00813051871955 -0.0153673645109
        1.3828344221275815 0.015398730956486372 0.08077832485708741</
        relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_pot::link</childLinkName>
98         <relativePose>0.023942 0.0237816 0.132364 -1.55141 -1.36676
            1.3834</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>

```

```

106
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116 </world>
117 </sdf>

```

207 worlds/scraping_{bw}ild_oowl_{bt}hin_spatula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_wildo_bowl_b_thin_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_thin_spatula</uri>
15       <pose>0.094321 0.507657 1.009274 -1.637236 0.074980 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.218391 0.495434 1.018867 1.118105 1.524620 2.552731</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_thin_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_wildo_bowl</uri>
30       <pose>0.078818 -0.501749 0.988186 3.097035 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://grripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_thin_spatula::link</childLinkName>
59         <relativePose>0.094321 0.007657 0.009274 -1.63724 0.07498
        -3.14159</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_wildo_bowl::link</childLinkName>
94         <relativePose>0.0089419 0.0135799 0.0780419 1.55636 1.32285
        -1.41637</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```


208 worlds/scraping_bfrying_pan_bspatula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_frying_pan_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.461945 1.549196 2.743082</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_frying_pan</uri>
30       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_spatula::link</childLinkName>
59         <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
        -3.14159</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_frying_pan::link</childLinkName>
94         <relativePose>0.0186144 0.0468562 0.224672 -1.55141 -1.36676
        1.3834</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

209 worlds/grabbing_book8.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30     <include>
31         <uri>model://finger</uri>
32         <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33     </include> -->
34
35     <include>
36         <uri>model://bookshelf_</uri>
37         <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38     </include>
39
40     <!-- Books -->
41
42
43     <!--<include>
44         <uri>model://book</uri>
45         <name>book3</name>
46         <pose>0.150000 0.624000 0.475000 0.000000 0.000000 1.57080</pose>
47     </include> -->
48
49
50     <model name='book_target'>
51         <static>false</static>
52         <pose>0.150000 0.861000 0.585000 0.000000 0.000000 1.57080</pose>
53
54         <link name='book_link'>
55             <pose frame='link'>0 0 0 0 0 0</pose>

```

```

56     <inertial>
57       <mass>0.1</mass>
58       <pose frame='link'>0 0 0 0 0 0</pose>
59       <inertia>
60         <ixx>0.00010416667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
61         <ixy>0</ixy>
62         <ixz>0</ixz>
63         <iyy>0.00010416667</iyy>
64         <iyz>0</iyz>
65         <izz>0.00004166667</izz>
66       </inertia>
67     </inertial>
68     <collision name='book_collision'>
69       <geometry>
70         <box>
71           <size>0.05 0.05 0.1</size>
72         </box>
73       </geometry>
74       <pose frame=''>0 0 0 0 0 0</pose>
75       <surface>
76         <friction>
77           <ode>
78             <mu>0.2</mu>
79             <mu2>0.2</mu2>
80           </ode>
81         </friction>
82       </surface>
83     </collision>
84     <visual name='book_visual'>
85       <geometry>
86         <box>
87           <size>0.05 0.05 0.1</size>
88         </box>
89       </geometry>
90       <pose frame=''>0 0 0 0 0 0</pose>
91     </visual>
92     <sensor name="main_bumper" type="contact">
93       <selfCollide>true</selfCollide>
94       <alwaysOn>true</alwaysOn>
95       <updateRate>15.0</updateRate>
96       <contact>
97         <collision>book_collision</collision>
98       </contact>
99       <!--<plugin name="gazebo_ros_bumper_controller" filename="
        libgazebo_ros_bumper.so">
100         <bumperTopicName>bumper_vals</bumperTopicName>
101         <frameName>book_target</frameName>
102       </plugin> -->
103     </sensor>
104   </link>
105   <plugin name="target_tf_broadcaster" filename="
    libtf_broadcaster_plugin.so">
106     <linkName>book_link</linkName>
107     <frameName>book_object_frame</frameName>
108   </plugin>
109   <plugin name="grasp" filename="libTiltGrabPlugin.so">
110     <parentLinkName>book_link</parentLinkName>

```

```

111     <childLinkName1>left_ee::link</childLinkName1>
112     <childLinkName2>right_ee::link</childLinkName2>
113     <childLinkName3>right_ee_2::link</childLinkName3>
114     <sensorName>book_contact</sensorName>
115   </plugin>
116 </model>
117
118
119
120 <!-- Left Gripper -->
121 <include>
122   <uri>model://finger</uri>
123   <name>left_ee</name>
124   <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
125
126
127   <plugin name="l_force_controller" filename="
128     libvelocity_controller_plugin.so">
129     <linkName>link</linkName>
130     <topicName>set_l_ee_twist</topicName>
131     <gains>
132       <linear>
133         <P>100.0</P>
134         <I>0.0</I>
135         <D>25.0</D>
136       </linear>
137       <angular>
138         <P>100.0</P>
139         <I>0.0</I>
140         <D>25.0</D>
141       </angular>
142     </gains>
143   </plugin>
144
145   <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
146     so">
147     <linkName>link</linkName>
148     <frameName>l_gripper_tool_frame</frameName>
149   </plugin>
150 </include>
151
152 <!-- Right Gripper -->
153 <include>
154   <uri>model://finger</uri>
155   <name>right_ee</name>
156   <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
157
158
159   <plugin name="r_force_controller" filename="
160     libvelocity_controller_plugin.so">
161     <linkName>link</linkName>
162     <topicName>set_r_ee_twist</topicName>
163     <gains>
164       <linear>

```

```

165         <angular>
166             <P>100.0</P>
167             <I>0.0</I>
168             <D>25.0</D>
169         </angular>
170     </gains>
171 </plugin>
172
173     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
174         so">
175         <linkName>link</linkName>
176         <frameName>r_gripper_tool_frame</frameName>
177     </plugin>
178 </include>
179
180 <include>
181     <uri>model://finger</uri>
182     <name>right_ee_2</name>
183     <pose>1.150000 0.700000 0.475000 0.000000 0.000000 1.57080</pose>
184
185     <plugin name="r_2_force_controller" filename="
186         libvelocity_controller_plugin.so">
187         <linkName>link</linkName>
188         <topicName>set_r_ee_2_twist</topicName>
189         <gains>
190             <linear>
191                 <P>100.0</P>
192                 <I>0.0</I>
193                 <D>25.0</D>
194             </linear>
195             <angular>
196                 <P>100.0</P>
197                 <I>0.0</I>
198                 <D>25.0</D>
199             </angular>
200         </gains>
201     </plugin>
202
203     <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
204         .so">
205         <linkName>link</linkName>
206         <frameName>r_2_gripper_tool_frame</frameName>
207     </plugin>
208 </include>
209
210 <plugin name="feature_visualization_plugin" filename="
211     libgiskard_visualization_plugin.so"></plugin>
212
213 <gui>
214     <camera name='user_camera'>
215         <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
216         <view_controller>orbit</view_controller>
217     </camera>
218 </gui>
219
220 </world>
221 </sdf>

```

210 worlds/scooping_{bb}bucket_{bs}erving_sspoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_bucket_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.100858 -0.510180 0.939254 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_bucket</uri>
30       <pose>0.100858 -0.510180 0.939254 -3.128475 -0.140461 3.129033</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.137579 0 0 -1.571974</pose>
36     </include>
37
38     <!-- Left Gripper -->
39     <include>
40       <uri>model://gripper</uri>
41       <name>left_ee</name>
42       <pose>0 0.5 1 0 0 0</pose>
43
44       <plugin name="l_force_controller" filename="
45         libvelocity_controller_plugin.so">
46         <linkName>link</linkName>
47         <topicName>set_l_ee_twist</topicName>
48         <gains>
49           <linear>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </linear>
54           <angular>

```



```

54         <P>100.0</P>
55         <I>0.0</I>
56         <D>25.0</D>
57     </angular>
58 </gains>
59 </plugin>
60
61 <plugin name="l_grip" filename="libGripPlugin.so">
62     <parentLinkName>link</parentLinkName>
63     <childLinkName>b_serving_spoon::link</childLinkName>
64     <relativePose>0.112571612 0.00813051871955 -0.0153673645109
        1.3828344221275815 0.015398730956486372 0.08077832485708741</
        relativePose>
65 </plugin>
66
67 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
68     <linkName>link</linkName>
69     <frameName>l_gripper_tool_frame</frameName>
70 </plugin>
71 </include>
72
73 <!-- Right Gripper -->
74 <include>
75     <uri>model://gripper</uri>
76     <name>right_ee</name>
77     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
78
79     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
80         <linkName>link</linkName>
81         <topicName>set_r_ee_twist</topicName>
82         <gains>
83             <linear>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </linear>
88             <angular>
89                 <P>100.0</P>
90                 <I>0.0</I>
91                 <D>25.0</D>
92             </angular>
93         </gains>
94     </plugin>
95
96     <plugin name="r_grip" filename="libGripPlugin.so">
97         <parentLinkName>link</parentLinkName>
98         <childLinkName>b_bucket::link</childLinkName>
99         <relativePose>0.0577053 0.0189525 0.101375 2.17015 1.31252
            2.31211</relativePose>
100     </plugin>
101
102     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
103         <linkName>link</linkName>
104         <frameName>r_gripper_tool_frame</frameName>

```

```

105         </plugin>
106     </include>
107
108     <plugin name="feature_visualization_plugin" filename="
109         libgiskard_visualization_plugin.so"></plugin>
110
111     <gui>
112         <camera name='user_camera'>
113             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
114             <view_controller>orbit</view_controller>
115         </camera>
116     </gui>
117 </world>
118 </sdf>

```

211 worlds/scraping_{bred_mug_{bs}patula_v.world}

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_red_mug_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.461945 1.549196 2.743082</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_red_mug</uri>
30       <pose>0.061612 -0.504614 1.006537 0.423677 0 3.060068</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_spatula::link</childLinkName>
59         <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
        -3.14159</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_red_mug::link</childLinkName>
94         <relativePose>-0.00780861 0.00428533 0.0614876 1.24173 -1.34456
        1.65836</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

212 worlds/scraping_{br}ed_mug_bserving_spoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_red_mug_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.198795 0.509112 0.981783 3.036336 1.368174 -1.866245</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_serving_spoon::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_red_mug</uri>
30       <pose>0.061612 -0.504614 1.006537 0.423677 0 3.060068</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_serving_spoon::link</childLinkName>
59         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
            1.3828344221275815 0.015398730956486372 0.08077832485708741</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_red_mug::link</childLinkName>
94         <relativePose>-0.00780861 0.00428533 0.0614876 1.24173 -1.34456
            1.65836</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104

```

```
105     <gui>
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```


213 worlds/scraping_{bred_mug_{bt}hin_spatula_v.world}

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_red_mug_b_thin_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_thin_spatula</uri>
15       <pose>0.094321 0.507657 1.009274 -1.637236 0.074980 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.218391 0.495434 1.018867 1.118105 1.524620 2.552731</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_thin_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_red_mug</uri>
30       <pose>0.061612 -0.504614 1.006537 0.423677 0 3.060068</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://grripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57     <parentLinkName>link</parentLinkName>
58     <childLinkName>b_thin_spatula::link</childLinkName>
59     <relativePose>0.094321 0.007657 0.009274 -1.63724 0.07498
        -3.14159</relativePose>
60 </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63     <linkName>link</linkName>
64     <frameName>l_gripper_tool_frame</frameName>
65 </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75     <linkName>link</linkName>
76     <topicName>set_r_ee_twist</topicName>
77     <gains>
78     <linear>
79     <P>100.0</P>
80     <I>0.0</I>
81     <D>25.0</D>
82     </linear>
83     <angular>
84     <P>100.0</P>
85     <I>0.0</I>
86     <D>25.0</D>
87     </angular>
88     </gains>
89 </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92     <parentLinkName>link</parentLinkName>
93     <childLinkName>b_red_mug::link</childLinkName>
94     <relativePose>-0.00780861 0.00428533 0.0614876 1.24173 -1.34456
        1.65836</relativePose>
95 </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98     <linkName>link</linkName>
99     <frameName>r_gripper_tool_frame</frameName>
100 </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

214 worlds/grabbing_bbook6.world

```
1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30     <include>
31         <uri>model://finger</uri>
32         <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33     </include> -->
34
35     <include>
36         <uri>model://bookshelf_</uri>
37         <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38     </include>
39
40     <!-- Books -->
41
42
43     <!--<include>
44         <uri>model://book</uri>
45         <name>book3</name>
46         <pose>0.150000 0.624000 0.475000 0.000000 0.000000 1.57080</pose>
47     </include> -->
48
49
50     <model name='book_target'>
51         <static>false</static>
52         <pose>0.150000 0.861000 0.585000 0.000000 0.000000 1.57080</pose>
53
54         <link name='book_link'>
55             <pose frame='link'>0 0 0 0 0 0</pose>
```

```

56     <inertial>
57       <mass>0.1</mass>
58       <pose frame='link'>0 0 0 0 0 0</pose>
59       <inertia>
60         <ixx>0.00041666667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
61         <ixy>0</ixy>
62         <ixz>0</ixz>
63         <iyy>0.00010416667</iyy>
64         <iyz>0</iyz>
65         <izz>0.00035416667</izz>
66       </inertia>
67     </inertial>
68     <collision name='book_collision'>
69       <geometry>
70         <box>
71           <size>0.05 0.2 0.1</size>
72         </box>
73       </geometry>
74       <pose frame=''>0 0 0 0 0 0</pose>
75       <surface>
76         <friction>
77           <ode>
78             <mu>0.2</mu>
79             <mu2>0.2</mu2>
80           </ode>
81         </friction>
82       </surface>
83     </collision>
84     <visual name='book_visual'>
85       <geometry>
86         <box>
87           <size>0.05 0.2 0.1</size>
88         </box>
89       </geometry>
90       <pose frame=''>0 0 0 0 0 0</pose>
91     </visual>
92     <sensor name="main_bumper" type="contact">
93       <selfCollide>true</selfCollide>
94       <alwaysOn>true</alwaysOn>
95       <updateRate>15.0</updateRate>
96       <contact>
97         <collision>book_collision</collision>
98       </contact>
99       <!--<plugin name="gazebo_ros_bumper_controller" filename="
100         libgazebo_ros_bumper.so">
101         <bumperTopicName>bumper_vals</bumperTopicName>
102         <frameName>book_target</frameName>
103       </plugin> -->
104     </sensor>
105   </link>
106   <plugin name="target_tf_broadcaster" filename="
107     libtf_broadcaster_plugin.so">
108     <linkName>book_link</linkName>
109     <frameName>book_object_frame</frameName>
110   </plugin>
111   <plugin name="grasp" filename="libTiltGrabPlugin.so">
112     <parentLinkName>book_link</parentLinkName>

```

```

111     <childLinkName1>left_ee::link</childLinkName1>
112     <childLinkName2>right_ee::link</childLinkName2>
113     <childLinkName3>right_ee_2::link</childLinkName3>
114     <sensorName>book_contact</sensorName>
115   </plugin>
116 </model>
117
118
119
120 <!-- Left Gripper -->
121 <include>
122   <uri>model://finger</uri>
123   <name>left_ee</name>
124   <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
125
126
127   <plugin name="l_force_controller" filename="
128     libvelocity_controller_plugin.so">
129     <linkName>link</linkName>
130     <topicName>set_l_ee_twist</topicName>
131     <gains>
132       <linear>
133         <P>100.0</P>
134         <I>0.0</I>
135         <D>25.0</D>
136       </linear>
137       <angular>
138         <P>100.0</P>
139         <I>0.0</I>
140         <D>25.0</D>
141       </angular>
142     </gains>
143   </plugin>
144
145   <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
146     so">
147     <linkName>link</linkName>
148     <frameName>l_gripper_tool_frame</frameName>
149   </plugin>
150 </include>
151
152 <!-- Right Gripper -->
153 <include>
154   <uri>model://finger</uri>
155   <name>right_ee</name>
156   <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
157
158
159   <plugin name="r_force_controller" filename="
160     libvelocity_controller_plugin.so">
161     <linkName>link</linkName>
162     <topicName>set_r_ee_twist</topicName>
163     <gains>
164       <linear>

```

```

165         <angular>
166             <P>100.0</P>
167             <I>0.0</I>
168             <D>25.0</D>
169         </angular>
170     </gains>
171 </plugin>
172
173     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
174         so">
175         <linkName>link</linkName>
176         <frameName>r_gripper_tool_frame</frameName>
177     </plugin>
178 </include>
179
180 <include>
181     <uri>model://finger</uri>
182     <name>right_ee_2</name>
183     <pose>1.150000 0.700000 0.475000 0.000000 0.000000 1.57080</pose>
184
185     <plugin name="r_2_force_controller" filename="
186         libvelocity_controller_plugin.so">
187         <linkName>link</linkName>
188         <topicName>set_r_ee_2_twist</topicName>
189         <gains>
190             <linear>
191                 <P>100.0</P>
192                 <I>0.0</I>
193                 <D>25.0</D>
194             </linear>
195             <angular>
196                 <P>100.0</P>
197                 <I>0.0</I>
198                 <D>25.0</D>
199             </angular>
200         </gains>
201     </plugin>
202
203     <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
204         .so">
205         <linkName>link</linkName>
206         <frameName>r_2_gripper_tool_frame</frameName>
207     </plugin>
208 </include>
209
210 <plugin name="feature_visualization_plugin" filename="
211     libgiskard_visualization_plugin.so"></plugin>
212
213 <gui>
214     <camera name='user_camera'>
215         <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
216         <view_controller>orbit</view_controller>
217     </camera>
218 </gui>
219
220 </world>
221 </sdf>

```

215 worlds/scraping_{bb}ucket_{bt}hin_spatula.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_bucket_b_thin_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_thin_spatula</uri>
15       <pose>0.094321 0.507657 1.009274 -1.637236 0.074980 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.218391 0.495434 1.018867 1.118105 1.524620 2.552731</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_thin_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_bucket</uri>
30       <pose>0.100858 -0.510180 0.939254 -3.128475 -0.140461 3.129033</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>

```



```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_thin_spatula::link</childLinkName>
59         <relativePose>0.094321 0.007657 0.009274 -1.63724 0.07498
60             -3.14159</relativePose>
61     </plugin>
62
63     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
64         so">
65         <linkName>link</linkName>
66         <frameName>l_gripper_tool_frame</frameName>
67     </plugin>
68 </include>
69
70 <!-- Right Gripper -->
71 <include>
72     <uri>model://gripper</uri>
73     <name>right_ee</name>
74     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
75
76     <plugin name="r_force_controller" filename="
77         libvelocity_controller_plugin.so">
78         <linkName>link</linkName>
79         <topicName>set_r_ee_twist</topicName>
80         <gains>
81             <linear>
82                 <P>100.0</P>
83                 <I>0.0</I>
84                 <D>25.0</D>
85             </linear>
86             <angular>
87                 <P>100.0</P>
88                 <I>0.0</I>
89                 <D>25.0</D>
90             </angular>
91         </gains>
92     </plugin>
93
94     <plugin name="r_grip" filename="libGripPlugin.so">
95         <parentLinkName>link</parentLinkName>
96         <childLinkName>b_bucket::link</childLinkName>
97         <relativePose>0.0577053 0.0189525 0.101375 2.17015 1.31252
98             2.31211</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
102         so">
103         <linkName>link</linkName>
104         <frameName>r_gripper_tool_frame</frameName>
105     </plugin>
106 </include>
107
108 <plugin name="feature_visualization_plugin" filename="
109     libgiskard_visualization_plugin.so"></plugin>
110

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```

216 worlds/grabbing_bbook7.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30         <include>
31             <uri>model://finger</uri>
32             <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33         </include> -->
34
35         <include>
36             <uri>model://bookshelf_</uri>
37             <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38         </include>
39
40         <!-- Books -->
41
42
43         <!--<include>
44             <uri>model://book</uri>
45             <name>book3</name>
46             <pose>0.150000 0.624000 0.475000 0.000000 0.000000 1.57080</pose>
47         </include> -->
48
49
50         <model name='book_target'>
51             <static>false</static>
52             <pose>0.150000 0.861000 0.585000 0.000000 0.000000 1.57080</pose>
53
54             <link name='book_link'>
55                 <pose frame='link'>0 0 0 0 0 0</pose>

```

```

56     <inertial>
57       <mass>0.1</mass>
58       <pose frame='link'>0 0 0 0 0 0</pose>
59       <inertia>
60         <ixx>0.00016666667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
61         <ixy>0</ixy>
62         <ixz>0</ixz>
63         <iyy>0.00010416667</iyy>
64         <iyz>0</iyz>
65         <izz>0.00010416667</izz>
66       </inertia>
67     </inertial>
68     <collision name='book_collision'>
69       <geometry>
70         <box>
71           <size>0.05 0.1 0.1</size>
72         </box>
73       </geometry>
74       <pose frame=''>0 0 0 0 0 0</pose>
75       <surface>
76         <friction>
77           <ode>
78             <mu>0.2</mu>
79             <mu2>0.2</mu2>
80           </ode>
81         </friction>
82       </surface>
83     </collision>
84     <visual name='book_visual'>
85       <geometry>
86         <box>
87           <size>0.05 0.1 0.1</size>
88         </box>
89       </geometry>
90       <pose frame=''>0 0 0 0 0 0</pose>
91     </visual>
92     <sensor name="main_bumper" type="contact">
93       <selfCollide>true</selfCollide>
94       <alwaysOn>true</alwaysOn>
95       <updateRate>15.0</updateRate>
96       <contact>
97         <collision>book_collision</collision>
98       </contact>
99       <!--<plugin name="gazebo_ros_bumper_controller" filename="
100         libgazebo_ros_bumper.so">
101         <bumperTopicName>bumper_vals</bumperTopicName>
102         <frameName>book_target</frameName>
103       </plugin> -->
104     </sensor>
105   </link>
106   <plugin name="target_tf_broadcaster" filename="
107     libtf_broadcaster_plugin.so">
108     <linkName>book_link</linkName>
109     <frameName>book_object_frame</frameName>
110   </plugin>
111   <plugin name="grasp" filename="libTiltGrabPlugin.so">
112     <parentLinkName>book_link</parentLinkName>

```

```

111     <childLinkName1>left_ee::link</childLinkName1>
112     <childLinkName2>right_ee::link</childLinkName2>
113     <childLinkName3>right_ee_2::link</childLinkName3>
114     <sensorName>book_contact</sensorName>
115   </plugin>
116 </model>
117
118
119
120 <!-- Left Gripper -->
121 <include>
122   <uri>model://finger</uri>
123   <name>left_ee</name>
124   <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
125
126
127   <plugin name="l_force_controller" filename="
128     libvelocity_controller_plugin.so">
129     <linkName>link</linkName>
130     <topicName>set_l_ee_twist</topicName>
131     <gains>
132       <linear>
133         <P>100.0</P>
134         <I>0.0</I>
135         <D>25.0</D>
136       </linear>
137       <angular>
138         <P>100.0</P>
139         <I>0.0</I>
140         <D>25.0</D>
141       </angular>
142     </gains>
143   </plugin>
144
145   <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
146     so">
147     <linkName>link</linkName>
148     <frameName>l_gripper_tool_frame</frameName>
149   </plugin>
150 </include>
151
152 <!-- Right Gripper -->
153 <include>
154   <uri>model://finger</uri>
155   <name>right_ee</name>
156   <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
157
158
159   <plugin name="r_force_controller" filename="
160     libvelocity_controller_plugin.so">
161     <linkName>link</linkName>
162     <topicName>set_r_ee_twist</topicName>
163     <gains>
164       <linear>

```

```

165         <angular>
166             <P>100.0</P>
167             <I>0.0</I>
168             <D>25.0</D>
169         </angular>
170     </gains>
171 </plugin>
172
173     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
174         so">
175         <linkName>link</linkName>
176         <frameName>r_gripper_tool_frame</frameName>
177     </plugin>
178 </include>
179
180 <include>
181     <uri>model://finger</uri>
182     <name>right_ee_2</name>
183     <pose>1.150000 0.700000 0.475000 0.000000 0.000000 1.57080</pose>
184
185     <plugin name="r_2_force_controller" filename="
186         libvelocity_controller_plugin.so">
187         <linkName>link</linkName>
188         <topicName>set_r_ee_2_twist</topicName>
189         <gains>
190             <linear>
191                 <P>100.0</P>
192                 <I>0.0</I>
193                 <D>25.0</D>
194             </linear>
195             <angular>
196                 <P>100.0</P>
197                 <I>0.0</I>
198                 <D>25.0</D>
199             </angular>
200         </gains>
201     </plugin>
202
203     <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
204         .so">
205         <linkName>link</linkName>
206         <frameName>r_2_gripper_tool_frame</frameName>
207     </plugin>
208 </include>
209
210 <plugin name="feature_visualization_plugin" filename="
211     libgiskard_visualization_plugin.so"></plugin>
212
213 <gui>
214     <camera name='user_camera'>
215         <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
216         <view_controller>orbit</view_controller>
217     </camera>
218 </gui>
219
220 </world>
221 </sdf>

```

217 worlds/scraping_{bbig}owl_{bk}knife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_big_bowl_b_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_knife</uri>
15       <pose>0.090993 0.503448 0.999041 -1.609842 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.200479 1.549194 2.743074</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_big_bowl</uri>
30       <pose>0.024164 -0.383989 0.959287 -0.017186 -0.000884 -0.101566</
31         pose>
32     </include>
33
34     <!-- Left Gripper -->
35     <include>
36       <uri>model://gripper</uri>
37       <name>left_ee</name>
38       <pose>0 0.5 1 0 0 0</pose>
39
40       <plugin name="l_force_controller" filename="
41         libvelocity_controller_plugin.so">
42         <linkName>link</linkName>
43         <topicName>set_l_ee_twist</topicName>
44         <gains>
45           <linear>
46             <P>100.0</P>
47             <I>0.0</I>
48             <D>25.0</D>
49           </linear>
50           <angular>
51             <P>100.0</P>
52             <I>0.0</I>
53             <D>25.0</D>
54           </angular>
55         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_knife::link</childLinkName>
59         <relativePose>0.090993 0.003448 -0.000959 -1.60984 0 0</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
            libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_big_bowl::link</childLinkName>
94         <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
            libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```



```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

218 worlds/scooping_{b_frying_pan_b_spatula_v.world}

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_frying_pan_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_frying_pan</uri>
30       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.065959 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43     <plugin name="l_force_controller" filename="
44       libvelocity_controller_plugin.so">
45       <linkName>link</linkName>
46       <topicName>set_l_ee_twist</topicName>
47       <gains>
48         <linear>
49           <P>100.0</P>
49           <I>0.0</I>
50           <D>25.0</D>
51         </linear>
52         <angular>
53           <P>100.0</P>
54           <I>0.0</I>

```

```

55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_spatula::link</childLinkName>
63     <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
        -3.14159</relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_frying_pan::link</childLinkName>
98         <relativePose>0.0186144 0.0468562 0.224672 -1.55141 -1.36676
            1.3834</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>
106

```

```
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116
117 </world>
118 </sdf>
```

219 worlds/scraping_{bbig}owl_{bt}hin_spatula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_big_bowl_b_thin_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_thin_spatula</uri>
15       <pose>0.094321 0.507657 1.009274 -1.637236 0.074980 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.218391 0.495434 1.018867 1.118105 1.524620 2.552731</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_thin_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_big_bowl</uri>
30       <pose>0.024164 -0.383989 0.959287 -0.017186 -0.000884 -0.101566</
31         pose>
32     </include>
33
34     <!-- Left Gripper -->
35     <include>
36       <uri>model://gripper</uri>
37       <name>left_ee</name>
38       <pose>0 0.5 1 0 0 0</pose>
39
40       <plugin name="l_force_controller" filename="
41         libvelocity_controller_plugin.so">
42         <linkName>link</linkName>
43         <topicName>set_l_ee_twist</topicName>
44         <gains>
45           <linear>
46             <P>100.0</P>
47             <I>0.0</I>
48             <D>25.0</D>
49           </linear>
50           <angular>
51             <P>100.0</P>
52             <I>0.0</I>
53             <D>25.0</D>
54           </angular>
55         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_thin_spatula::link</childLinkName>
59         <relativePose>0.094321 0.007657 0.009274 -1.63724 0.07498
60             -3.14159</relativePose>
61     </plugin>
62
63     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
64         so">
65         <linkName>link</linkName>
66         <frameName>l_gripper_tool_frame</frameName>
67     </plugin>
68 </include>
69
70 <!-- Right Gripper -->
71 <include>
72     <uri>model://gripper</uri>
73     <name>right_ee</name>
74     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
75
76     <plugin name="r_force_controller" filename="
77         libvelocity_controller_plugin.so">
78         <linkName>link</linkName>
79         <topicName>set_r_ee_twist</topicName>
80         <gains>
81             <linear>
82                 <P>100.0</P>
83                 <I>0.0</I>
84                 <D>25.0</D>
85             </linear>
86             <angular>
87                 <P>100.0</P>
88                 <I>0.0</I>
89                 <D>25.0</D>
90             </angular>
91         </gains>
92     </plugin>
93
94     <plugin name="r_grip" filename="libGripPlugin.so">
95         <parentLinkName>link</parentLinkName>
96         <childLinkName>b_big_bowl::link</childLinkName>
97         <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
98     </plugin>
99
100     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
101         so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>
106
107 <plugin name="feature_visualization_plugin" filename="
108     libgiskard_visualization_plugin.so"></plugin>
109
110 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

220 worlds/scraping_{bc}of_{fee}cup_{bt}able_kknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_coffee_cup_b_table_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_table_knife</uri>
15       <pose>0.060878 0.497562 1.005864 1.616805 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.135713 0.488941 1.003983 0.274231 1.507716 1.875637</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_table_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_coffee_cup</uri>
30       <pose>-0.016492 -0.468631 0.965206 2.603069 -1.513021 -2.66073</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>

```



```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_table_knife::link</childLinkName>
59         <relativePose>0.060878 -0.002438 0.005864 1.6168 0 0</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
63         so">
64         <linkName>link</linkName>
65         <frameName>l_gripper_tool_frame</frameName>
66     </plugin>
67 </include>
68
69 <!-- Right Gripper -->
70 <include>
71     <uri>model://gripper</uri>
72     <name>right_ee</name>
73     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
74
75     <plugin name="r_force_controller" filename="
76         libvelocity_controller_plugin.so">
77         <linkName>link</linkName>
78         <topicName>set_r_ee_twist</topicName>
79         <gains>
80             <linear>
81                 <P>100.0</P>
82                 <I>0.0</I>
83                 <D>25.0</D>
84             </linear>
85             <angular>
86                 <P>100.0</P>
87                 <I>0.0</I>
88                 <D>25.0</D>
89             </angular>
90         </gains>
91     </plugin>
92
93     <plugin name="r_grip" filename="libGripPlugin.so">
94         <parentLinkName>link</parentLinkName>
95         <childLinkName>b_coffee_cup::link</childLinkName>
96         <relativePose>0.0284501 0.0346428 -0.0213798 2.93848 0.00496188
97             2.88401</relativePose>
98     </plugin>
99
100     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
101         so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
</include>
<plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```

221 worlds/grabbing_bbook5.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30         <include>
31             <uri>model://finger</uri>
32             <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33         </include> -->
34
35         <include>
36             <uri>model://bookshelf_</uri>
37             <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38         </include>
39
40         <!-- Books -->
41
42
43         <!--<include>
44             <uri>model://book</uri>
45             <name>book3</name>
46             <pose>0.150000 0.624000 0.475000 0.000000 0.000000 1.57080</pose>
47         </include> -->
48
49
50         <model name='book_target'>
51             <static>false</static>
52             <pose>0.150000 0.861000 0.585000 0.000000 0.000000 1.57080</pose>
53
54             <link name='book_link'>
55                 <pose frame='link'>0 0 0 0 0 0</pose>

```

```

56     <inertial>
57       <mass>0.1</mass>
58       <pose frame='link'>0 0 0 0 0 0</pose>
59       <inertia>
60         <ixx>0.000666667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
61         <ixy>0</ixy>
62         <ixz>0</ixz>
63         <iyy>0.00035416667</iyy>
64         <iyz>0</iyz>
65         <izz>0.00035416667</izz>
66       </inertia>
67     </inertial>
68     <collision name='book_collision'>
69       <geometry>
70         <box>
71           <size>0.05 0.2 0.2</size>
72         </box>
73       </geometry>
74       <pose frame=''>0 0 0 0 0 0</pose>
75       <surface>
76         <friction>
77           <ode>
78             <mu>0.2</mu>
79             <mu2>0.2</mu2>
80           </ode>
81         </friction>
82       </surface>
83     </collision>
84     <visual name='book_visual'>
85       <geometry>
86         <box>
87           <size>0.05 0.2 0.2</size>
88         </box>
89       </geometry>
90       <pose frame=''>0 0 0 0 0 0</pose>
91     </visual>
92     <sensor name="main_bumper" type="contact">
93       <selfCollide>true</selfCollide>
94       <alwaysOn>true</alwaysOn>
95       <updateRate>15.0</updateRate>
96       <contact>
97         <collision>book_collision</collision>
98       </contact>
99       <!--<plugin name="gazebo_ros_bumper_controller" filename="
100         libgazebo_ros_bumper.so">
101         <bumperTopicName>bumper_vals</bumperTopicName>
102         <frameName>book_target</frameName>
103       </plugin> -->
104     </sensor>
105   </link>
106   <plugin name="target_tf_broadcaster" filename="
107     libtf_broadcaster_plugin.so">
108     <linkName>book_link</linkName>
109     <frameName>book_object_frame</frameName>
110   </plugin>
111   <plugin name="grasp" filename="libTiltGrabPlugin.so">
112     <parentLinkName>book_link</parentLinkName>

```

```

111     <childLinkName1>left_ee::link</childLinkName1>
112     <childLinkName2>right_ee::link</childLinkName2>
113     <childLinkName3>right_ee_2::link</childLinkName3>
114     <sensorName>book_contact</sensorName>
115   </plugin>
116 </model>
117
118
119
120 <!-- Left Gripper -->
121 <include>
122   <uri>model://finger</uri>
123   <name>left_ee</name>
124   <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
125
126
127   <plugin name="l_force_controller" filename="
128     libvelocity_controller_plugin.so">
129     <linkName>link</linkName>
130     <topicName>set_l_ee_twist</topicName>
131     <gains>
132       <linear>
133         <P>100.0</P>
134         <I>0.0</I>
135         <D>25.0</D>
136       </linear>
137       <angular>
138         <P>100.0</P>
139         <I>0.0</I>
140         <D>25.0</D>
141       </angular>
142     </gains>
143   </plugin>
144
145   <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
146     so">
147     <linkName>link</linkName>
148     <frameName>l_gripper_tool_frame</frameName>
149   </plugin>
150 </include>
151
152 <!-- Right Gripper -->
153 <include>
154   <uri>model://finger</uri>
155   <name>right_ee</name>
156   <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
157
158
159   <plugin name="r_force_controller" filename="
160     libvelocity_controller_plugin.so">
161     <linkName>link</linkName>
162     <topicName>set_r_ee_twist</topicName>
163     <gains>
164       <linear>
165         <P>100.0</P>
166         <I>0.0</I>
167         <D>25.0</D>
168       </linear>

```

```

165         <angular>
166             <P>100.0</P>
167             <I>0.0</I>
168             <D>25.0</D>
169         </angular>
170     </gains>
171 </plugin>
172
173     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
174         <linkName>link</linkName>
175         <frameName>r_gripper_tool_frame</frameName>
176     </plugin>
177 </include>
178
179 <include>
180     <uri>model://finger</uri>
181     <name>right_ee_2</name>
182     <pose>1.150000 0.700000 0.475000 0.000000 0.000000 1.57080</pose>
183
184     <plugin name="r_2_force_controller" filename="
        libvelocity_controller_plugin.so">
185         <linkName>link</linkName>
186         <topicName>set_r_ee_2_twist</topicName>
187         <gains>
188             <linear>
189                 <P>100.0</P>
190                 <I>0.0</I>
191                 <D>25.0</D>
192             </linear>
193             <angular>
194                 <P>100.0</P>
195                 <I>0.0</I>
196                 <D>25.0</D>
197             </angular>
198         </gains>
199     </plugin>
200
201     <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
        .so">
202         <linkName>link</linkName>
203         <frameName>r_2_gripper_tool_frame</frameName>
204     </plugin>
205 </include>
206
207 <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
208
209 <gui>
210     <camera name='user_camera'>
211         <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
212         <view_controller>orbit</view_controller>
213     </camera>
214 </gui>
215
216 </world>
217 </sdf>

```

222 worlds/jenga_tower.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="big_bowl_spatula_v">
4
5      <!-- <physics type="ode">
6        <max_step_size>0.001</max_step_size>
7        <real_time_factor>1</real_time_factor>
8        <real_time_update_rate>1000</real_time_update_rate>
9        <bullet>
10         <solver>
11           <iters>70</iters>
12         </solver>
13       </bullet>
14       <ode>
15         <solver>
16           <iters>70</iters>
17         </solver>
18       </ode>
19     </physics> -->
20
21     <include>
22       <uri>model://sun</uri>
23     </include>
24
25     <include>
26       <uri>model://ground_plane</uri>
27     </include>
28
29     <!-- level 0 -->
30     <include>
31       <uri>model://jenga_block</uri> <!-- 2.5x7.5x1.5 -->
32       <name>book_target</name>
33       <pose>0.115000 0.660000 0.007500 -1.570796 1.570796 0.00</pose>
34
35       <plugin name="target_tf_broadcaster" filename="
36         libtf_broadcaster_plugin.so">
37         <linkName>link</linkName>
38         <frameName>book_object_frame</frameName>
39       </plugin>
40     </include>
41     <include>
42       <uri>model://jenga_block</uri>
43       <name>block2</name>
44       <pose>0.090000 0.660000 0.007500 -1.570796 1.570796 0.00</pose>
45     </include>
46     <include>
47       <uri>model://jenga_block</uri>
48       <name>block3</name>
49       <pose>0.065000 0.660000 0.007500 -1.570796 1.570796 0.00</pose>
50     </include>
51     <!-- level 1 -->
52     <include>
53       <uri>model://jenga_block</uri>
54       <name>block4</name>
55       <pose>0.090000 0.685000 0.022550 3.141593 1.570796 0.00</pose>

```

```

55     </include>
56     <include>
57         <uri>model://jenga_block</uri>
58         <name>block5</name>
59         <pose>0.090000 0.660000 0.022550 3.141593 1.570796 0.00</pose>
60     </include>
61     <include>
62         <uri>model://jenga_block</uri>
63         <name>block6</name>
64         <pose>0.090000 0.635000 0.022550 3.141593 1.570796 0.00</pose>
65     </include>
66     <!-- level 2 -->
67     <include>
68         <uri>model://jenga_block</uri> <!-- 2.5x7.5x1.5 -->
69         <name>block7</name>
70         <pose>0.115000 0.660000 0.037600 -1.570796 1.570796 0.00</pose>
71     </include>
72     <include>
73         <uri>model://jenga_block</uri>
74         <name>block8</name>
75         <pose>0.090000 0.660000 0.037600 -1.570796 1.570796 0.00</pose>
76     </include>
77     <include>
78         <uri>model://jenga_block</uri>
79         <name>block9</name>
80         <pose>0.065000 0.660000 0.037600 -1.570796 1.570796 0.00</pose>
81     </include>
82     <!-- level 3 -->
83     <include>
84         <uri>model://jenga_block</uri>
85         <name>block10</name>
86         <pose>0.090000 0.685000 0.052650 3.141593 1.570796 0.00</pose>
87     </include>
88     <include>
89         <uri>model://jenga_block</uri>
90         <name>block11</name>
91         <pose>0.090000 0.660000 0.052650 3.141593 1.570796 0.00</pose>
92     </include>
93     <include>
94         <uri>model://jenga_block</uri>
95         <name>block12</name>
96         <pose>0.090000 0.635000 0.052650 3.141593 1.570796 0.00</pose>
97     </include>
98     <!-- level 4 -->
99     <include>
100         <uri>model://jenga_block</uri> <!-- 2.5x7.5x1.5 -->
101         <name>block13</name>
102         <pose>0.115000 0.660000 0.067700 -1.570796 1.570796 0.00</pose>
103     </include>
104     <include>
105         <uri>model://jenga_block</uri>
106         <name>block14</name>
107         <pose>0.090000 0.660000 0.067700 -1.570796 1.570796 0.00</pose>
108     </include>
109     <include>
110         <uri>model://jenga_block</uri>
111         <name>block15</name>

```



```

112     <pose>0.065000 0.660000 0.067700 -1.570796 1.570796 0.00</pose>
113 </include>
114 <!-- level 5 -->
115 <include>
116     <uri>model://jenga_block</uri>
117     <name>block16</name>
118     <pose>0.090000 0.685000 0.082750 3.141593 1.570796 0.00</pose>
119 </include>
120 <include>
121     <uri>model://jenga_block</uri>
122     <name>block17</name>
123     <pose>0.090000 0.660000 0.082750 3.141593 1.570796 0.00</pose>
124 </include>
125 <include>
126     <uri>model://jenga_block</uri>
127     <name>block18</name>
128     <pose>0.090000 0.635000 0.082750 3.141593 1.570796 0.00</pose>
129 </include>
130 <!-- level 6 -->
131 <include>
132     <uri>model://jenga_block</uri> <!-- 2.5x7.5x1.5 -->
133     <name>block19</name>
134     <pose>0.115000 0.660000 0.097800 -1.570796 1.570796 0.00</pose>
135 </include>
136 <include>
137     <uri>model://jenga_block</uri>
138     <name>block20</name>
139     <pose>0.090000 0.660000 0.097800 -1.570796 1.570796 0.00</pose>
140 </include>
141 <include>
142     <uri>model://jenga_block</uri>
143     <name>block21</name>
144     <pose>0.065000 0.660000 0.097800 -1.570796 1.570796 0.00</pose>
145 </include>
146
147
148
149
150 <!-- Left Gripper -->
151 <include>
152     <uri>model://finger</uri>
153     <name>left_ee</name>
154     <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
155
156
157     <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
158         <linkName>link</linkName>
159         <topicName>set_l_ee_twist</topicName>
160         <gains>
161             <linear>
162                 <P>100.0</P>
163                 <I>0.0</I>
164                 <D>25.0</D>
165             </linear>
166             <angular>
167                 <P>100.0</P>

```

```

168         <I>0.0</I>
169         <D>25.0</D>
170     </angular>
171 </gains>
172 </plugin>
173
174     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
175         <linkName>link</linkName>
176         <frameName>l_gripper_tool_frame</frameName>
177     </plugin>
178 </include>
179
180 <!-- Right Gripper -->
181 <include>
182     <uri>model://finger</uri>
183     <name>right_ee</name>
184     <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
185
186     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
187         <linkName>link</linkName>
188         <topicName>set_r_ee_twist</topicName>
189         <gains>
190             <linear>
191                 <P>100.0</P>
192                 <I>0.0</I>
193                 <D>25.0</D>
194             </linear>
195             <angular>
196                 <P>100.0</P>
197                 <I>0.0</I>
198                 <D>25.0</D>
199             </angular>
200         </gains>
201     </plugin>
202
203     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
204         <linkName>link</linkName>
205         <frameName>r_gripper_tool_frame</frameName>
206     </plugin>
207 </include>
208
209 <include>
210     <uri>model://finger</uri>
211     <name>right_ee_2</name>
212     <pose>1.150000 0.7000000 0.475000 0.000000 0.000000 1.57080</pose>
213
214     <plugin name="r_2_force_controller" filename="
        libvelocity_controller_plugin.so">
215         <linkName>link</linkName>
216         <topicName>set_r_ee_2_twist</topicName>
217         <gains>
218             <linear>
219                 <P>100.0</P>
220                 <I>0.0</I>

```

```

221         <D>25.0</D>
222     </linear>
223     <angular>
224         <P>100.0</P>
225         <I>0.0</I>
226         <D>25.0</D>
227     </angular>
228 </gains>
229 </plugin>
230
231 <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
232     .so">
233     <linkName>link</linkName>
234     <frameName>r_2_gripper_tool_frame</frameName>
235 </plugin>
236 </include>
237
238 <plugin name="feature_visualization_plugin" filename="
239     libgiskard_visualization_plugin.so"></plugin>
240
241 <gui>
242     <camera name='user_camera'>
243         <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
244         <view_controller>orbit</view_controller>
245     </camera>
246 </gui>
247 </world>
248 </sdf>

```

223 worlds/grabbing_book3.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30     <include>
31         <uri>model://finger</uri>
32         <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33     </include> -->
34
35     <include>
36         <uri>model://bookshelf_</uri>
37         <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38     </include>
39
40     <!-- Books -->
41
42
43     <!--<include>
44         <uri>model://book</uri>
45         <name>book3</name>
46         <pose>0.150000 0.624000 0.475000 0.000000 0.000000 1.57080</pose>
47     </include> -->
48
49
50     <model name='book_target'>
51         <static>false</static>
52         <pose>0.150000 0.861000 0.585000 0.000000 0.000000 1.57080</pose>
53
54         <link name='book_link'>
55             <pose frame='link'>0 0 0 0 0 0</pose>

```

```

56     <inertial>
57       <mass>0.1</mass>
58       <pose frame='link'>0 0 0 0 0 0</pose>
59       <inertia>
60         <ixx>0.000666667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
61         <ixy>0</ixy>
62         <ixz>0</ixz>
63         <iyy>0.00241667</iyy>
64         <iyz>0</iyz>
65         <izz>0.00241667</izz>
66       </inertia>
67     </inertial>
68     <collision name='book_collision'>
69       <geometry>
70         <box>
71           <size>0.5 0.2 0.2</size>
72         </box>
73       </geometry>
74       <pose frame=''>0 0 0 0 0 0</pose>
75       <surface>
76         <friction>
77           <ode>
78             <mu>0.2</mu>
79             <mu2>0.2</mu2>
80           </ode>
81         </friction>
82       </surface>
83     </collision>
84     <visual name='book_visual'>
85       <geometry>
86         <box>
87           <size>0.5 0.2 0.2</size>
88         </box>
89       </geometry>
90       <pose frame=''>0 0 0 0 0 0</pose>
91     </visual>
92     <sensor name="main_bumper" type="contact">
93       <selfCollide>true</selfCollide>
94       <alwaysOn>true</alwaysOn>
95       <updateRate>15.0</updateRate>
96       <contact>
97         <collision>book_collision</collision>
98       </contact>
99       <!--<plugin name="gazebo_ros_bumper_controller" filename="
100         libgazebo_ros_bumper.so">
101         <bumperTopicName>bumper_vals</bumperTopicName>
102         <frameName>book_target</frameName>
103       </plugin> -->
104     </sensor>
105   </link>
106   <plugin name="target_tf_broadcaster" filename="
107     libtf_broadcaster_plugin.so">
108     <linkName>book_link</linkName>
109     <frameName>book_object_frame</frameName>
110   </plugin>
111   <plugin name="grasp" filename="libTiltGrabPlugin.so">
112     <parentLinkName>book_link</parentLinkName>

```

```

111     <childLinkName1>left_ee::link</childLinkName1>
112     <childLinkName2>right_ee::link</childLinkName2>
113     <childLinkName3>right_ee_2::link</childLinkName3>
114     <sensorName>book_contact</sensorName>
115   </plugin>
116 </model>
117
118
119
120 <!-- Left Gripper -->
121 <include>
122   <uri>model://finger</uri>
123   <name>left_ee</name>
124   <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
125
126
127   <plugin name="l_force_controller" filename="
128     libvelocity_controller_plugin.so">
129     <linkName>link</linkName>
130     <topicName>set_l_ee_twist</topicName>
131     <gains>
132       <linear>
133         <P>100.0</P>
134         <I>0.0</I>
135         <D>25.0</D>
136       </linear>
137       <angular>
138         <P>100.0</P>
139         <I>0.0</I>
140         <D>25.0</D>
141       </angular>
142     </gains>
143   </plugin>
144
145   <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
146     so">
147     <linkName>link</linkName>
148     <frameName>l_gripper_tool_frame</frameName>
149   </plugin>
150 </include>
151
152 <!-- Right Gripper -->
153 <include>
154   <uri>model://finger</uri>
155   <name>right_ee</name>
156   <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
157
158
159   <plugin name="r_force_controller" filename="
160     libvelocity_controller_plugin.so">
161     <linkName>link</linkName>
162     <topicName>set_r_ee_twist</topicName>
163     <gains>
164       <linear>

```

```

165         <angular>
166             <P>100.0</P>
167             <I>0.0</I>
168             <D>25.0</D>
169         </angular>
170     </gains>
171 </plugin>
172
173     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
174         <linkName>link</linkName>
175         <frameName>r_gripper_tool_frame</frameName>
176     </plugin>
177 </include>
178
179 <include>
180     <uri>model://finger</uri>
181     <name>right_ee_2</name>
182     <pose>1.150000 0.700000 0.475000 0.000000 0.000000 1.57080</pose>
183
184     <plugin name="r_2_force_controller" filename="
        libvelocity_controller_plugin.so">
185         <linkName>link</linkName>
186         <topicName>set_r_ee_2_twist</topicName>
187         <gains>
188             <linear>
189                 <P>100.0</P>
190                 <I>0.0</I>
191                 <D>25.0</D>
192             </linear>
193             <angular>
194                 <P>100.0</P>
195                 <I>0.0</I>
196                 <D>25.0</D>
197             </angular>
198         </gains>
199     </plugin>
200
201     <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
        .so">
202         <linkName>link</linkName>
203         <frameName>r_2_gripper_tool_frame</frameName>
204     </plugin>
205 </include>
206
207 <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
208
209 <gui>
210     <camera name='user_camera'>
211         <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
212         <view_controller>orbit</view_controller>
213     </camera>
214 </gui>
215
216 </world>
217 </sdf>

```

224 worlds/scooping_{bw}ildo_bowl_{bs}erving_spoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_wildo_bowl_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.078818 -0.501749 0.988186 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_wildo_bowl</uri>
30       <pose>0.078818 -0.501749 0.988186 3.097035 0 0</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.066428 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43     <plugin name="l_force_controller" filename="
44       libvelocity_controller_plugin.so">
45       <linkName>link</linkName>
46       <topicName>set_l_ee_twist</topicName>
47       <gains>
48         <linear>
49           <P>100.0</P>
50           <I>0.0</I>
51           <D>25.0</D>
52         </linear>
53         <angular>
54           <P>100.0</P>
55           <I>0.0</I>

```



```

55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_serving_spoon::link</childLinkName>
63     <relativePose>0.112571612 0.00813051871955 -0.0153673645109
        1.3828344221275815 0.015398730956486372 0.08077832485708741</
        relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_wildo_bowl::link</childLinkName>
98         <relativePose>0.0089419 0.0135799 0.0780419 1.55636 1.32285
            -1.41637</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>

```

```

106
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116 </world>
117 </sdf>

```

225 worlds/scraping_bfrying_pan_{bt}thin_spatula.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_frying_pan_btthin_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_thin_spatula</uri>
15       <pose>0.094321 0.507657 1.009274 -1.637236 0.074980 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.218391 0.495434 1.018867 1.118105 1.524620 2.552731</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_thin_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_frying_pan</uri>
30       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://grripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_thin_spatula::link</childLinkName>
59         <relativePose>0.094321 0.007657 0.009274 -1.63724 0.07498
        -3.14159</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_frying_pan::link</childLinkName>
94         <relativePose>0.0186144 0.0468562 0.224672 -1.55141 -1.36676
        1.3834</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

226 worlds/scraping_{bpot}_{bs}erving_spoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_pot_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.198795 0.509112 0.981783 3.036336 1.368174 -1.866245</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_serving_spoon::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_pot</uri>
30       <pose>0.133471 -0.503990 0.971217 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_serving_spoon::link</childLinkName>
59         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
            1.3828344221275815 0.015398730956486372 0.08077832485708741</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_pot::link</childLinkName>
94         <relativePose>0.023942 0.0237816 0.132364 -1.55141 -1.36676
            1.3834</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```


227 worlds/freezer_{box}2.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30     <include>
31         <uri>model://finger</uri>
32         <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33     </include> -->
34
35     <include>
36         <uri>model://freezer_box</uri>
37         <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38     </include>
39
40
41
42     <model name='book_target'>
43         <static>false</static>
44         <pose>0.220000 0.000000 0.300000 1.570796 0.000000 0.000000</pose>
45
46     <link name='book_link'>
47         <pose frame='link'>0.0 0.0 0.0 0.0 0 0</pose>
48         <inertial>
49             <mass>1</mass>
50             <pose frame='link'>0.0 0.0 0.0 0 0 0</pose>
51             <inertia>
52                 <ixx>0.0416666</ixx><!-- 1/12 * m * (h^2 + d^2) -->
53                 <ixy>0</ixy>
54                 <ixz>0</ixz>
55                 <iyy>0.0416666</iyy>

```

```

56         <iyz>0</iyz>
57         <izz>0.0416666</izz>
58     </inertia>
59 </inertial>
60 <collision name='book_collision'>
61     <geometry>
62         <box>
63             <size>0.5 0.5 0.5</size>
64         </box>
65     </geometry>
66     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
67     <surface>
68         <friction>
69             <ode>
70                 <mu>0.2</mu>
71                 <mu2>0.2</mu2>
72             </ode>
73         </friction>
74     </surface>
75 </collision>
76 <visual name='book_visual'>
77     <geometry>
78         <box>
79             <size>0.5 0.5 0.5</size>
80         </box>
81     </geometry>
82     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
83 </visual>
84 <sensor name="main_bumper" type="contact">
85     <selfCollide>true</selfCollide>
86     <alwaysOn>true</alwaysOn>
87     <updateRate>15.0</updateRate>
88     <contact>
89         <collision>book_collision</collision>
90     </contact>
91 </sensor>
92 </link>
93 <plugin name="target_tf_broadcaster" filename="
    libtf_broadcaster_plugin.so">
94     <linkName>book_link</linkName>
95     <frameName>book_object_frame</frameName>
96 </plugin>
97 <plugin name="grasp" filename="libTiltGrabPlugin.so">
98     <parentLinkName>book_link</parentLinkName>
99     <childLinkName1>left_ee::link</childLinkName1>
100    <childLinkName2>right_ee::link</childLinkName2>
101    <childLinkName3>right_ee_2::link</childLinkName3>
102    <sensorName>book_contact</sensorName>
103 </plugin>
104 </model>
105
106
107
108 <!-- Left Gripper -->
109 <include>
110     <uri>model://finger</uri>
111     <name>left_ee</name>

```

```

112     <pose>0.000000 0.000000 0.880000 0.000000 0.000000 1.57080</pose>
113
114
115     <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
116         <linkName>link</linkName>
117         <topicName>set_l_ee_twist</topicName>
118         <gains>
119             <linear>
120                 <P>100.0</P>
121                 <I>0.0</I>
122                 <D>25.0</D>
123             </linear>
124             <angular>
125                 <P>100.0</P>
126                 <I>0.0</I>
127                 <D>25.0</D>
128             </angular>
129         </gains>
130     </plugin>
131
132     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
133         <linkName>link</linkName>
134         <frameName>l_gripper_tool_frame</frameName>
135     </plugin>
136 </include>
137
138 <!-- Right Gripper -->
139 <include>
140     <uri>model://finger</uri>
141     <name>right_ee</name>
142     <pose>0.600000 0.500000 0.830000 0.000000 0.000000 1.57080</pose>
143
144     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
145         <linkName>link</linkName>
146         <topicName>set_r_ee_twist</topicName>
147         <gains>
148             <linear>
149                 <P>100.0</P>
150                 <I>0.0</I>
151                 <D>25.0</D>
152             </linear>
153             <angular>
154                 <P>100.0</P>
155                 <I>0.0</I>
156                 <D>25.0</D>
157             </angular>
158         </gains>
159     </plugin>
160
161     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
162         <linkName>link</linkName>
163         <frameName>r_gripper_tool_frame</frameName>
164     </plugin>

```

```

165     </include>
166
167     <include>
168         <uri>model://finger</uri>
169         <name>right_ee_2</name>
170         <pose>0.600000 -0.500000 0.830000 0.000000 0.000000 1.57080</pose>
171
172         <plugin name="r_2_force_controller" filename="
            libvelocity_controller_plugin.so">
173             <linkName>link</linkName>
174             <topicName>set_r_ee_2_twist</topicName>
175             <gains>
176                 <linear>
177                     <P>100.0</P>
178                     <I>0.0</I>
179                     <D>25.0</D>
180                 </linear>
181                 <angular>
182                     <P>100.0</P>
183                     <I>0.0</I>
184                     <D>25.0</D>
185                 </angular>
186             </gains>
187         </plugin>
188
189         <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
            .so">
190             <linkName>link</linkName>
191             <frameName>r_2_gripper_tool_frame</frameName>
192         </plugin>
193     </include>
194
195     <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
196
197     <gui>
198         <camera name='user_camera'>
199             <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
200             <view_controller>orbit</view_controller>
201         </camera>
202     </gui>
203
204 </world>
205 </sdf>

```

228 worlds/scraping_{bc}of_{fee}cup_{bs}erving_{spoon}_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_coffee_cup_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.198795 0.509112 0.981783 3.036336 1.368174 -1.866245</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_serving_spoon::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_coffee_cup</uri>
30       <pose>-0.016492 -0.468631 0.965206 2.603069 -1.513021 -2.66073</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_serving_spoon::link</childLinkName>
59         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
            1.3828344221275815 0.015398730956486372 0.08077832485708741</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_coffee_cup::link</childLinkName>
94         <relativePose>0.0284501 0.0346428 -0.0213798 2.93848 0.00496188
            2.88401</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>

```

```
104
105     <gui>
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

229 worlds/grabbing_{book.world}

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30         <include>
31             <uri>model://finger</uri>
32             <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33         </include> -->
34
35         <include>
36             <uri>model://bookshelf_</uri>
37             <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38         </include>
39
40         <!-- Books -->
41         <include>
42             <uri>model://book</uri>
43             <name>book1</name>
44             <pose>0.150000 0.550000 0.475000 0.000000 0.000000 1.57080</pose>
45         </include>
46
47         <include>
48             <uri>model://book</uri>
49             <name>book2</name>
50             <pose>0.150000 0.587000 0.475000 0.000000 0.000000 1.57080</pose>
51         </include>
52
53         <!--<include>
54             <uri>model://book</uri>
55             <name>book3</name>

```



```

56     <pose>0.150000 0.624000 0.475000 0.000000 0.000000 1.57080</pose>
57 </include> -->
58
59
60 <model name='book_target'>
61   <static>false</static>
62   <pose>0.150000 0.661000 0.475000 0.000000 0.000000 1.57080</pose>
63
64   <link name='book_link'>
65     <pose frame='link'>-0.031125 0 0.010809 1e-06 -0 0</pose>
66     <inertial>
67       <mass>1</mass>
68       <pose frame='link'>0.03 0 0.18 0 -0 0</pose>
69       <inertia>
70         <ixx>.01495105</ixx><!-- 1/12 * m * (h^2 + d^2) -->
71         <ixy>0</ixy>
72         <ixz>0</ixz>
73         <iyy>0.01270166</iyy>
74         <iyz>0</iyz>
75         <izz>0.00247143</izz>
76       </inertia>
77     </inertial>
78     <collision name='book_collision'>
79       <geometry>
80         <mesh>
81           <uri>model://book/book.stl</uri>
82         </mesh>
83       </geometry>
84       <pose frame=''>0.26 0 -0.32 0 -0 0</pose>
85       <surface>
86         <friction>
87           <ode>
88             <mu>0.2</mu>
89             <mu2>0.2</mu2>
90           </ode>
91         </friction>
92       </surface>
93     </collision>
94     <visual name='book_visual'>
95       <geometry>
96         <mesh>
97           <uri>model://book/book.stl</uri>
98         </mesh>
99       </geometry>
100      <pose frame=''>0.26 0 -0.32 0 -0 0</pose>
101    </visual>
102    <sensor name="main_bumper" type="contact">
103      <selfCollide>true</selfCollide>
104      <alwaysOn>true</alwaysOn>
105      <updateRate>15.0</updateRate>
106      <contact>
107        <collision>book_collision</collision>
108      </contact>
109      <!--<plugin name="gazebo_ros_bumper_controller" filename="
110        libgazebo_ros_bumper.so">
111        <bumperTopicName>bumper_vals</bumperTopicName>
112        <frameName>book_target</frameName>

```

```

112     </plugin> -->
113 </sensor>
114 </link>
115 <plugin name="target_tf_broadcaster" filename="
116     libtf_broadcaster_plugin.so">
117     <linkName>book_link</linkName>
118     <frameName>book_object_frame</frameName>
119 </plugin>
120 <plugin name="grasp" filename="libTiltGrabPlugin.so">
121     <parentLinkName>book_link</parentLinkName>
122     <childLinkName1>left_ee::link</childLinkName1>
123     <childLinkName2>right_ee::link</childLinkName2>
124     <childLinkName3>right_ee_2::link</childLinkName3>
125     <sensorName>book_contact</sensorName>
126 </plugin>
127 </model>
128 <!--<include>
129     <uri>model://book</uri>
130     <name>book5</name>
131     <pose>0.150000 0.698000 0.475000 0.000000 0.000000 1.57080</pose>
132 </include> -->
133
134 <include>
135     <uri>model://book</uri>
136     <name>book6</name>
137     <pose>0.150000 0.735000 0.475000 0.000000 0.000000 1.57080</pose>
138 </include>
139
140 <include>
141     <uri>model://book</uri>
142     <name>book7</name>
143     <pose>0.150000 0.772000 0.475000 0.000000 0.000000 1.57080</pose>
144 </include>
145
146 <include>
147     <uri>model://book</uri>
148     <name>book8</name>
149     <pose>0.150000 0.809000 0.475000 0.000000 0.000000 1.57080</pose>
150 </include>
151
152 <include>
153     <uri>model://book</uri>
154     <name>book9</name>
155     <pose>0.150000 0.846000 0.475000 0.000000 0.000000 1.57080</pose>
156 </include>
157
158 <!-- Leaning Books
159 <include>
160     <uri>model://book</uri>
161     <name>book6</name>
162     <pose>0.150000 0.768000 0.475000 0.000000 -0.084533 1.57080</pose>
163 </include>
164
165 <include>
166     <uri>model://book</uri>
167     <name>book7</name>

```

```

168     <pose>0.150000 0.840000 0.475000 0.000000 -0.174533 1.57080</pose>
169 </include>
170
171 <include>
172     <uri>model://book</uri>
173     <name>book8</name>
174     <pose>0.150000 0.947000 0.475000 0.000000 -0.349066 1.57080</pose>
175 </include>
176
177 <include>
178     <uri>model://book</uri>
179     <name>book9</name>
180     <pose>0.150000 1.10000 0.475000 0.000000 -0.523599 1.57080</pose>
181 </include>
182 -->
183
184 <!-- Left Gripper -->
185 <include>
186     <uri>model://finger</uri>
187     <name>left_ee</name>
188     <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
189
190
191     <plugin name="l_force_controller" filename="
192         libvelocity_controller_plugin.so">
193         <linkName>link</linkName>
194         <topicName>set_l_ee_twist</topicName>
195         <gains>
196             <linear>
197                 <P>100.0</P>
198                 <I>0.0</I>
199                 <D>25.0</D>
200             </linear>
201             <angular>
202                 <P>100.0</P>
203                 <I>0.0</I>
204                 <D>25.0</D>
205             </angular>
206         </gains>
207     </plugin>
208
209     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
210         so">
211         <linkName>link</linkName>
212         <frameName>l_gripper_tool_frame</frameName>
213     </plugin>
214 </include>
215
216 <!-- Right Gripper -->
217 <include>
218     <uri>model://finger</uri>
219     <name>right_ee</name>
220     <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
221
222     <plugin name="r_force_controller" filename="
223         libvelocity_controller_plugin.so">
224         <linkName>link</linkName>

```

```

222     <topicName>set_r_ee_twist</topicName>
223     <gains>
224         <linear>
225             <P>100.0</P>
226             <I>0.0</I>
227             <D>25.0</D>
228         </linear>
229         <angular>
230             <P>100.0</P>
231             <I>0.0</I>
232             <D>25.0</D>
233         </angular>
234     </gains>
235 </plugin>
236
237 <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
    so">
238     <linkName>link</linkName>
239     <frameName>r_gripper_tool_frame</frameName>
240 </plugin>
241 </include>
242
243 <include>
244     <uri>model://finger</uri>
245     <name>right_ee_2</name>
246     <pose>1.150000 0.7000000 0.475000 0.000000 0.000000 1.57080</pose>
247
248     <plugin name="r_2_force_controller" filename="
        libvelocity_controller_plugin.so">
249         <linkName>link</linkName>
250         <topicName>set_r_ee_2_twist</topicName>
251         <gains>
252             <linear>
253                 <P>100.0</P>
254                 <I>0.0</I>
255                 <D>25.0</D>
256             </linear>
257             <angular>
258                 <P>100.0</P>
259                 <I>0.0</I>
260                 <D>25.0</D>
261             </angular>
262         </gains>
263     </plugin>
264
265     <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
        .so">
266         <linkName>link</linkName>
267         <frameName>r_2_gripper_tool_frame</frameName>
268     </plugin>
269 </include>
270
271 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
272
273 <gui>
274     <camera name='user_camera'>

```

```
275         <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
276         <view_controller>orbit</view_controller>
277     </camera>
278 </gui>
279
280 </world>
281 </sdf>
```

230 worlds/scraping_{bb}big_bowl_{bs}erving_spoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="big_bowl_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.198795 0.509112 0.981783 3.036336 1.368174 -1.866245</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_serving_spoon::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_big_bowl</uri>
30       <pose>0.024164 -0.383989 0.959287 -0.017186 -0.000884 -0.101566</
31         pose>
32     </include>
33
34     <!-- Left Gripper -->
35     <include>
36       <uri>model://gripper</uri>
37       <name>left_ee</name>
38       <pose>0 0.5 1 0 0 0</pose>
39
40       <plugin name="l_force_controller" filename="
41         libvelocity_controller_plugin.so">
42         <linkName>link</linkName>
43         <topicName>set_l_ee_twist</topicName>
44         <gains>
45           <linear>
46             <P>100.0</P>
47             <I>0.0</I>
48             <D>25.0</D>
49           </linear>
50           <angular>
51             <P>100.0</P>
52             <I>0.0</I>
53             <D>25.0</D>
54           </angular>
55         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_serving_spoon::link</childLinkName>
59         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
            1.3828344221275815 0.015398730956486372 0.08077832485708741</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_big_bowl::link</childLinkName>
94         <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```


231 worlds/scraping_{bbigowl}_{bspatula_v}.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="big_bowl_spatula_v">
4
5      <!-- <physics type="ode">
6        <max_step_size>0.001</max_step_size>
7        <real_time_factor>1</real_time_factor>
8        <real_time_update_rate>1000</real_time_update_rate>
9        <bullet>
10         <solver>
11           <iters>70</iters>
12         </solver>
13       </bullet>
14       <ode>
15         <solver>
16           <iters>70</iters>
17         </solver>
18       </ode>
19     </physics> -->
20
21     <include>
22       <uri>model://sun</uri>
23     </include>
24
25     <include>
26       <uri>model://ground_plane</uri>
27     </include>
28
29     <include>
30       <uri>model://b_spatula</uri>
31       <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
32     </include>
33
34     <include>
35       <uri>model://butter_box</uri>
36       <pose>0.208221 0.534198 0.991390 1.634659 1.569999 -0.001148</pose>
37       <plugin name="stick" filename="libStickPlugin.so">
38         <parentLinkName>link</parentLinkName>
39         <childLinkName>b_spatula::link</childLinkName>
40         <force>5</force>
41       </plugin>
42     </include>
43
44     <include>
45       <uri>model://b_big_bowl</uri>
46       <pose>0.024164 -0.383989 0.959287 -0.017186 -0.000884 -0.101566</
pose>
47     </include>
48
49     <!-- Left Gripper -->
50     <include>
51       <uri>model://gripper</uri>
52       <name>left_ee</name>
53       <pose>0 0.5 1 0 0 0</pose>
54

```

```

55     <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
56     <linkName>link</linkName>
57     <topicName>set_l_ee_twist</topicName>
58     <gains>
59         <linear>
60             <P>0.1</P>
61             <I>0.0</I>
62             <D>0.02</D>
63         </linear>
64         <angular>
65             <P>0.0001</P>
66             <I>0.0</I>
67             <D>0.000002</D>
68         </angular>
69     </gains>
70 </plugin>
71
72 <plugin name="l_grip" filename="libGripPlugin.so">
73     <parentLinkName>link</parentLinkName>
74     <childLinkName>b_spatula::link</childLinkName>
75     <relativePose>0.14 0.028 -0.002 -1.57 3.20 0.20</relativePose>
76 </plugin>
77
78 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
79     <linkName>link</linkName>
80     <frameName>l_gripper_tool_frame</frameName>
81 </plugin>
82 </include>
83
84 <!-- Right Gripper -->
85 <include>
86     <uri>model://gripper</uri>
87     <name>right_ee</name>
88     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
89
90     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
91     <linkName>link</linkName>
92     <topicName>set_r_ee_twist</topicName>
93     <gains>
94         <linear>
95             <P>0.1</P>
96             <I>0.0</I>
97             <D>0.02</D>
98         </linear>
99         <angular>
100             <P>0.1</P>
101             <I>0.0</I>
102             <D>0.002</D>
103         </angular>
104     </gains>
105 </plugin>
106
107 <plugin name="r_grip" filename="libGripPlugin.so">
108     <parentLinkName>link</parentLinkName>

```

```

109         <childLinkName>b_big_bowl::link</childLinkName>
110         <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
111     </plugin>
112
113     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
114         so">
115         <linkName>link</linkName>
116         <frameName>r_gripper_tool_frame</frameName>
117     </plugin>
118 </include>
119
120 <plugin name="feature_visualization_plugin" filename="
121     libgiskard_visualization_plugin.so"></plugin>
122
123 <gui>
124     <camera name='user_camera'>
125         <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
126         <view_controller>orbit</view_controller>
127     </camera>
128 </gui>
129 </world>
130 </sdf>

```

232 worlds/scraping_{bc}of_{fee}cup_{bk}knife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_coffee_cup_b_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_knife</uri>
15       <pose>0.090993 0.503448 0.999041 -1.609842 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.200479 1.549194 2.743074</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_coffee_cup</uri>
30       <pose>-0.016492 -0.468631 0.965206 2.603069 -1.513021 -2.66073</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_knife::link</childLinkName>
59         <relativePose>0.090993 0.003448 -0.000959 -1.60984 0 0</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
            libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_coffee_cup::link</childLinkName>
94         <relativePose>0.0284501 0.0346428 -0.0213798 2.93848 0.00496188
            2.88401</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
            libgiskard_visualization_plugin.so"></plugin>
104

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```

233 worlds/scraping_{bp}ot_{bt}able_kknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_pot_b_table_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_table_knife</uri>
15       <pose>0.060878 0.497562 1.005864 1.616805 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.135713 0.488941 1.003983 0.274231 1.507716 1.875637</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_table_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_pot</uri>
30       <pose>0.133471 -0.503990 0.971217 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_table_knife::link</childLinkName>
59         <relativePose>0.060878 -0.002438 0.005864 1.6168 0 0</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
63         so">
64         <linkName>link</linkName>
65         <frameName>l_gripper_tool_frame</frameName>
66     </plugin>
67 </include>
68
69 <!-- Right Gripper -->
70 <include>
71     <uri>model://gripper</uri>
72     <name>right_ee</name>
73     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
74
75     <plugin name="r_force_controller" filename="
76         libvelocity_controller_plugin.so">
77         <linkName>link</linkName>
78         <topicName>set_r_ee_twist</topicName>
79         <gains>
80             <linear>
81                 <P>100.0</P>
82                 <I>0.0</I>
83                 <D>25.0</D>
84             </linear>
85             <angular>
86                 <P>100.0</P>
87                 <I>0.0</I>
88                 <D>25.0</D>
89             </angular>
90         </gains>
91     </plugin>
92
93     <plugin name="r_grip" filename="libGripPlugin.so">
94         <parentLinkName>link</parentLinkName>
95         <childLinkName>b_pot::link</childLinkName>
96         <relativePose>0.023942 0.0237816 0.132364 -1.55141 -1.36676
97             1.3834</relativePose>
98     </plugin>
99
100     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
101         so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>
106
107 <plugin name="feature_visualization_plugin" filename="
108     libgiskard_visualization_plugin.so"></plugin>
109
110 <gui>

```



```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

234 worlds/scooping_{bb}ucket_{bs}patula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_bucket_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.100858 -0.510180 0.939254 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_bucket</uri>
30       <pose>0.100858 -0.510180 0.939254 -3.128475 -0.140461 3.129033</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.137579 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43       <plugin name="l_force_controller" filename="
44         libvelocity_controller_plugin.so">
45         <linkName>link</linkName>
46         <topicName>set_l_ee_twist</topicName>
47         <gains>
48           <linear>
49             <P>100.0</P>
50             <I>0.0</I>
51             <D>25.0</D>
52           </linear>
53           <angular>

```

```

54         <I>0.0</I>
55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_spatula::link</childLinkName>
63     <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
        -3.14159</relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_bucket::link</childLinkName>
98         <relativePose>0.0577053 0.0189525 0.101375 2.17015 1.31252
            2.31211</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>

```

```

106
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116 </world>
117 </sdf>

```

235 worlds/scraping_{bc}of_{fee}c_{up}_bs_{patula}_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_coffee_cup_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_thin_spatula</uri>
15       <pose>0.094321 0.507657 1.009274 -1.637236 0.074980 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.218391 0.495434 1.018867 1.118105 1.524620 2.552731</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_thin_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_coffee_cup</uri>
30       <pose>-0.016492 -0.468631 0.965206 2.603069 -1.513021 -2.66073</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_thin_spatula::link</childLinkName>
59         <relativePose>0.094321 0.007657 0.009274 -1.63724 0.07498
60             -3.14159</relativePose>
61     </plugin>
62
63     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
64         so">
65         <linkName>link</linkName>
66         <frameName>l_gripper_tool_frame</frameName>
67     </plugin>
68 </include>
69
70 <!-- Right Gripper -->
71 <include>
72     <uri>model://gripper</uri>
73     <name>right_ee</name>
74     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
75
76     <plugin name="r_force_controller" filename="
77         libvelocity_controller_plugin.so">
78         <linkName>link</linkName>
79         <topicName>set_r_ee_twist</topicName>
80         <gains>
81             <linear>
82                 <P>100.0</P>
83                 <I>0.0</I>
84                 <D>25.0</D>
85             </linear>
86             <angular>
87                 <P>100.0</P>
88                 <I>0.0</I>
89                 <D>25.0</D>
90             </angular>
91         </gains>
92     </plugin>
93
94     <plugin name="r_grip" filename="libGripPlugin.so">
95         <parentLinkName>link</parentLinkName>
96         <childLinkName>b_coffee_cup::link</childLinkName>
97         <relativePose>0.0284501 0.0346428 -0.0213798 2.93848 0.00496188
98             2.88401</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
102         so">
103         <linkName>link</linkName>
104         <frameName>r_gripper_tool_frame</frameName>
105     </plugin>
106 </include>
107
108 <plugin name="feature_visualization_plugin" filename="
109     libgiskard_visualization_plugin.so"></plugin>

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```

236 worlds/scraping_{bb}bucket_bserving_spoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_bucket_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.198795 0.509112 0.981783 3.036336 1.368174 -1.866245</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_serving_spoon::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_bucket</uri>
30       <pose>0.100858 -0.510180 0.939254 -3.128475 -0.140461 3.129033</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>

```



```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_serving_spoon::link</childLinkName>
59         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
            1.3828344221275815 0.015398730956486372 0.08077832485708741</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_bucket::link</childLinkName>
94         <relativePose>0.0577053 0.0189525 0.101375 2.17015 1.31252
            2.31211</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>

```

```
104
105     <gui>
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

237 worlds/scraping_{bb}bucket_{bs}patula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_bucket_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.461945 1.549196 2.743082</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_bucket</uri>
30       <pose>0.100858 -0.510180 0.939254 -3.128475 -0.140461 3.129033</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_spatula::link</childLinkName>
59         <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
60             -3.14159</relativePose>
61     </plugin>
62
63     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
64         so">
65         <linkName>link</linkName>
66         <frameName>l_gripper_tool_frame</frameName>
67     </plugin>
68 </include>
69
70 <!-- Right Gripper -->
71 <include>
72     <uri>model://gripper</uri>
73     <name>right_ee</name>
74     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
75
76     <plugin name="r_force_controller" filename="
77         libvelocity_controller_plugin.so">
78         <linkName>link</linkName>
79         <topicName>set_r_ee_twist</topicName>
80         <gains>
81             <linear>
82                 <P>100.0</P>
83                 <I>0.0</I>
84                 <D>25.0</D>
85             </linear>
86             <angular>
87                 <P>100.0</P>
88                 <I>0.0</I>
89                 <D>25.0</D>
90             </angular>
91         </gains>
92     </plugin>
93
94     <plugin name="r_grip" filename="libGripPlugin.so">
95         <parentLinkName>link</parentLinkName>
96         <childLinkName>b_bucket::link</childLinkName>
97         <relativePose>0.0577053 0.0189525 0.101375 2.17015 1.31252
98             2.31211</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
102         so">
103         <linkName>link</linkName>
104         <frameName>r_gripper_tool_frame</frameName>
105     </plugin>
106 </include>
107
108 <plugin name="feature_visualization_plugin" filename="
109     libgiskard_visualization_plugin.so"></plugin>
110

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```

238 worlds/scooping_bfrying_{pan}_bserving_{spoon}_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_frying_pan_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_frying_pan</uri>
30       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.065959 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43     <plugin name="l_force_controller" filename="
44       libvelocity_controller_plugin.so">
45       <linkName>link</linkName>
46       <topicName>set_l_ee_twist</topicName>
47       <gains>
48         <linear>
49           <P>100.0</P>
50           <I>0.0</I>
51           <D>25.0</D>
52         </linear>
53         <angular>
54           <P>100.0</P>
55           <I>0.0</I>

```

```

55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_serving_spoon::link</childLinkName>
63     <relativePose>0.112571612 0.00813051871955 -0.0153673645109
        1.3828344221275815 0.015398730956486372 0.08077832485708741</
        relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_frying_pan::link</childLinkName>
98         <relativePose>0.0186144 0.0468562 0.224672 -1.55141 -1.36676
            1.3834</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>

```

```

106
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116 </world>
117 </sdf>

```


239 worlds/scooping_{br}ed_mug_{bs}patula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_red_mug_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.061612 -0.504614 1.006537 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_red_mug</uri>
30       <pose>0.061612 -0.504614 1.006537 0.423677 0 3.060068</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.066428 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43     <plugin name="l_force_controller" filename="
44       libvelocity_controller_plugin.so">
45       <linkName>link</linkName>
46       <topicName>set_l_ee_twist</topicName>
47       <gains>
48         <linear>
49           <P>100.0</P>
50           <I>0.0</I>
51           <D>25.0</D>
52         </linear>
53         <angular>
54           <P>100.0</P>
55           <I>0.0</I>

```

```

55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_spatula::link</childLinkName>
63     <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
        -3.14159</relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_red_mug::link</childLinkName>
98         <relativePose>-0.00780861 0.00428533 0.0614876 1.24173 -1.34456
            1.65836</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>
106

```

```
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116
117 </world>
118 </sdf>
```

240 worlds/cutting_table_bs_{patula}_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="scraping">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://table</uri>
15       <pose>0 0 0 0 0 -1.57694</pose>
16       <static>true</static>
17     </include>
18
19     <include>
20       <uri>model://b_spatula</uri>
21       <pose>0.140489 0.527566 1.397957 1.571605 -0.058101 -2.939758</pose>
22     </include>
23
24     <plugin name="lasagna_factory" filename="libLasagnaFactoryPlugin.so">
25       <pose>0 0 1.035 0 0 0</pose>
26       <size>8 8 2</size>
27       <radius>0.01</radius>
28       <friction>0.1</friction>
29       <friction2>0.1</friction2>
30       <jointDamping>10</jointDamping>
31       <jointFriction>5</jointFriction>
32     </plugin>
33
34     <!-- Left Gripper -->
35     <include>
36       <uri>model://gripper</uri>
37       <name>left_ee</name>
38       <pose>0 0.5 1.4 0 0 0</pose>
39
40       <plugin name="l_force_controller" filename="
41         libvelocity_controller_plugin.so">
42         <linkName>link</linkName>
43         <topicName>set_l_ee_twist</topicName>
44         <gains>
45           <linear>
46             <P>100.0</P>
47             <I>0.0</I>
48             <D>25.0</D>
49           </linear>
50           <angular>
51             <P>100.0</P>
52             <I>0.0</I>
53             <D>25.0</D>
54           </angular>
55         </gains>

```

```

55     </plugin>
56
57     <plugin name="l_grip" filename="libGripPlugin.so">
58         <parentLinkName>link</parentLinkName>
59         <childLinkName>b_spatula::link</childLinkName>
60         <relativePose>0.14 0.028 -0.002 -1.57 3.20 0.20</relativePose>
61     </plugin>
62
63     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
64         <linkName>link</linkName>
65         <frameName>l_gripper_tool_frame</frameName>
66     </plugin>
67 </include>
68
69 <!-- Right Gripper -->
70 <include>
71     <uri>model://gripper</uri>
72     <name>right_ee</name>
73     <pose>0 -0.5 1.039100 1.547368 1.402341 1.343703</pose>
74
75     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
76         <linkName>link</linkName>
77         <topicName>set_r_ee_twist</topicName>
78         <gains>
79             <linear>
80                 <P>100.0</P>
81                 <I>0.0</I>
82                 <D>25.0</D>
83             </linear>
84             <angular>
85                 <P>100.0</P>
86                 <I>0.0</I>
87                 <D>25.0</D>
88             </angular>
89         </gains>
90     </plugin>
91
92     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
93         <linkName>link</linkName>
94         <frameName>r_gripper_tool_frame</frameName>
95     </plugin>
96 </include>
97
98
99 <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
100
101 <gui>
102     <camera name='user_camera'>
103         <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
104         <view_controller>orbit</view_controller>
105     </camera>
106 </gui>
107

```

```
108     </world>
109 </sdf>
```

241 worlds/freezer_{box}6.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30     <include>
31         <uri>model://finger</uri>
32         <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33     </include> -->
34
35     <include>
36         <uri>model://freezer_box</uri>
37         <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38     </include>
39
40
41
42     <model name='book_target'>
43         <static>false</static>
44         <pose>0.220000 0.000000 0.300000 1.570796 0.000000 0.000000</pose>
45
46     <link name='book_link'>
47         <pose frame='link'>0.0 0.0 0.0 0.0 0 0</pose>
48         <inertial>
49             <mass>0.1</mass>
50             <pose frame='link'>0.0 0.0 0.0 0 0 0</pose>
51             <inertia>
52                 <ixx>0.002416667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
53                 <ixy>0</ixy>
54                 <ixz>0</ixz>
55                 <iyy>0.000666667</iyy>

```

```

56         <iyz>0</iyz>
57         <izz>0.002416667</izz>
58     </inertia>
59 </inertial>
60 <collision name='book_collision'>
61     <geometry>
62         <box>
63             <size>0.2 0.5 0.2</size>
64         </box>
65     </geometry>
66     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
67     <surface>
68         <friction>
69             <ode>
70                 <mu>0.2</mu>
71                 <mu2>0.2</mu2>
72             </ode>
73         </friction>
74     </surface>
75 </collision>
76 <visual name='book_visual'>
77     <geometry>
78         <box>
79             <size>0.2 0.5 0.2</size>
80         </box>
81     </geometry>
82     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
83 </visual>
84 <sensor name="main_bumper" type="contact">
85     <selfCollide>true</selfCollide>
86     <alwaysOn>true</alwaysOn>
87     <updateRate>15.0</updateRate>
88     <contact>
89         <collision>book_collision</collision>
90     </contact>
91 </sensor>
92 </link>
93 <plugin name="target_tf_broadcaster" filename="
    libtf_broadcaster_plugin.so">
94     <linkName>book_link</linkName>
95     <frameName>book_object_frame</frameName>
96 </plugin>
97 <plugin name="grasp" filename="libTiltGrabPlugin.so">
98     <parentLinkName>book_link</parentLinkName>
99     <childLinkName1>left_ee::link</childLinkName1>
100    <childLinkName2>right_ee::link</childLinkName2>
101    <childLinkName3>right_ee_2::link</childLinkName3>
102    <sensorName>book_contact</sensorName>
103 </plugin>
104 </model>
105
106
107
108 <!-- Left Gripper -->
109 <include>
110     <uri>model://finger</uri>
111     <name>left_ee</name>

```



```

112     <pose>0.000000 0.000000 0.880000 0.000000 0.000000 1.57080</pose>
113
114
115     <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
116         <linkName>link</linkName>
117         <topicName>set_l_ee_twist</topicName>
118         <gains>
119             <linear>
120                 <P>100.0</P>
121                 <I>0.0</I>
122                 <D>25.0</D>
123             </linear>
124             <angular>
125                 <P>100.0</P>
126                 <I>0.0</I>
127                 <D>25.0</D>
128             </angular>
129         </gains>
130     </plugin>
131
132     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
133         <linkName>link</linkName>
134         <frameName>l_gripper_tool_frame</frameName>
135     </plugin>
136 </include>
137
138 <!-- Right Gripper -->
139 <include>
140     <uri>model://finger</uri>
141     <name>right_ee</name>
142     <pose>0.600000 0.500000 0.830000 0.000000 0.000000 1.57080</pose>
143
144     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
145         <linkName>link</linkName>
146         <topicName>set_r_ee_twist</topicName>
147         <gains>
148             <linear>
149                 <P>100.0</P>
150                 <I>0.0</I>
151                 <D>25.0</D>
152             </linear>
153             <angular>
154                 <P>100.0</P>
155                 <I>0.0</I>
156                 <D>25.0</D>
157             </angular>
158         </gains>
159     </plugin>
160
161     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
162         <linkName>link</linkName>
163         <frameName>r_gripper_tool_frame</frameName>
164     </plugin>

```

```

165     </include>
166
167     <include>
168         <uri>model://finger</uri>
169         <name>right_ee_2</name>
170         <pose>0.600000 -0.500000 0.830000 0.000000 0.000000 1.57080</pose>
171
172         <plugin name="r_2_force_controller" filename="
            libvelocity_controller_plugin.so">
173             <linkName>link</linkName>
174             <topicName>set_r_ee_2_twist</topicName>
175             <gains>
176                 <linear>
177                     <P>100.0</P>
178                     <I>0.0</I>
179                     <D>25.0</D>
180                 </linear>
181                 <angular>
182                     <P>100.0</P>
183                     <I>0.0</I>
184                     <D>25.0</D>
185                 </angular>
186             </gains>
187         </plugin>
188
189         <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
            .so">
190             <linkName>link</linkName>
191             <frameName>r_2_gripper_tool_frame</frameName>
192         </plugin>
193     </include>
194
195     <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
196
197     <gui>
198         <camera name='user_camera'>
199             <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
200             <view_controller>orbit</view_controller>
201         </camera>
202     </gui>
203
204 </world>
205 </sdf>

```

242 worlds/scraping_{bw}ild_oowl_{bs}erving_spoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_wildo_bowl_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.198795 0.509112 0.981783 3.036336 1.368174 -1.866245</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_serving_spoon::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_wildo_bowl</uri>
30       <pose>0.078818 -0.501749 0.988186 3.097035 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_serving_spoon::link</childLinkName>
59         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
            1.3828344221275815 0.015398730956486372 0.08077832485708741</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_wildo_bowl::link</childLinkName>
94         <relativePose>0.0089419 0.0135799 0.0780419 1.55636 1.32285
            -1.41637</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104

```

```
105     <gui>
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

243 worlds/scooping_{bc}of_{fee}cup_{bt}able_kknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_coffee_cup_b_table_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_table_knife</uri>
15       <pose>0.060878 0.497562 1.005864 1.616805 0 0</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>-0.016492 -0.468631 0.965206 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_coffee_cup</uri>
30       <pose>-0.016492 -0.468631 0.965206 2.603069 -1.513021 -2.66073</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_table_knife::link</childLinkName>
59         <relativePose>0.060878 -0.002438 0.005864 1.6168 0 0</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_coffee_cup::link</childLinkName>
94         <relativePose>0.0284501 0.0346428 -0.0213798 2.93848 0.00496188
            2.88401</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```


244 worlds/scraping_{bb}big_bowl_{bs}erving_sspoon_p.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="big_bowl_serving_spoon_p">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.198795 0.509112 0.981783 3.036336 1.368174 -1.866245</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_serving_spoon::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_big_bowl</uri>
30       <pose>0.024164 -0.383989 0.959287 -0.017186 -0.000884 -0.101566</
31         pose>
32     </include>
33
34     <!-- Left Gripper -->
35     <include>
36       <uri>model://gripper</uri>
37       <name>left_ee</name>
38       <pose>0 0.5 1 0 0 0</pose>
39
40       <plugin name="l_position_controller" filename="
41         libposition_controller_plugin.so">
42         <linkName>link</linkName>
43         <referenceFrameName>base_link</referenceFrameName>
44         <targetFrameName>l_gripper_tool_frame</targetFrameName>
45         <P>100.0</P>
46         <I>0.0</I>
47         <D>50.0</D>
48       </plugin>
49
50       <plugin name="l_grip" filename="libGripPlugin.so">
51         <parentLinkName>link</parentLinkName>
52         <childLinkName>b_serving_spoon::link</childLinkName>
53         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
54           1.3828344221275815 0.015398730956486372 0.08077832485708741</
55           relativePose>

```

```

52     </plugin>
53 </include>
54
55 <!-- Right Gripper -->
56 <include>
57     <uri>model://gripper</uri>
58     <name>right_ee</name>
59     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
60
61     <plugin name="r_position_controller" filename="
        libposition_controller_plugin.so">
62         <linkName>link</linkName>
63         <referenceFrameName>base_link</referenceFrameName>
64         <targetFrameName>r_gripper_tool_frame</targetFrameName>
65         <P>100.0</P>
66         <I>0.0</I>
67         <D>50.0</D>
68     </plugin>
69
70     <plugin name="r_grip" filename="libGripPlugin.so">
71         <parentLinkName>link</parentLinkName>
72         <childLinkName>b_big_bowl::link</childLinkName>
73         <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
74     </plugin>
75 </include>
76
77 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
78
79 <gui>
80     <camera name='user_camera'>
81         <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
82         <view_controller>orbit</view_controller>
83     </camera>
84 </gui>
85
86 </world>
87 </sdf>

```

245 worlds/scraping_{bc}of_{fee}cup_{bt}hin_spatula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_coffee_cup_b_thin_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_thin_spatula</uri>
15       <pose>0.094321 0.507657 1.009274 -1.637236 0.074980 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.218391 0.495434 1.018867 1.118105 1.524620 2.552731</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_thin_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_coffee_cup</uri>
30       <pose>-0.016492 -0.468631 0.965206 2.603069 -1.513021 -2.66073</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_thin_spatula::link</childLinkName>
59         <relativePose>0.094321 0.007657 0.009274 -1.63724 0.07498
60             -3.14159</relativePose>
61     </plugin>
62
63     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
64         so">
65         <linkName>link</linkName>
66         <frameName>l_gripper_tool_frame</frameName>
67     </plugin>
68 </include>
69
70 <!-- Right Gripper -->
71 <include>
72     <uri>model://gripper</uri>
73     <name>right_ee</name>
74     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
75
76     <plugin name="r_force_controller" filename="
77         libvelocity_controller_plugin.so">
78         <linkName>link</linkName>
79         <topicName>set_r_ee_twist</topicName>
80         <gains>
81             <linear>
82                 <P>100.0</P>
83                 <I>0.0</I>
84                 <D>25.0</D>
85             </linear>
86             <angular>
87                 <P>100.0</P>
88                 <I>0.0</I>
89                 <D>25.0</D>
90             </angular>
91         </gains>
92     </plugin>
93
94     <plugin name="r_grip" filename="libGripPlugin.so">
95         <parentLinkName>link</parentLinkName>
96         <childLinkName>b_coffee_cup::link</childLinkName>
97         <relativePose>0.0284501 0.0346428 -0.0213798 2.93848 0.00496188
98             2.88401</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
102         so">
103         <linkName>link</linkName>
104         <frameName>r_gripper_tool_frame</frameName>
105     </plugin>
106 </include>
107
108 <plugin name="feature_visualization_plugin" filename="
109     libgiskard_visualization_plugin.so"></plugin>

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```

246 worlds/freezer_{box}.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30     <include>
31         <uri>model://finger</uri>
32         <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33     </include> -->
34
35     <include>
36         <uri>model://freezer_box</uri>
37         <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38     </include>
39
40
41
42     <model name='book_target'>
43         <static>false</static>
44         <pose>0.220000 0.000000 0.300000 1.570796 0.000000 0.000000</pose>
45
46     <link name='book_link'>
47         <pose frame='link'>0.0 0.0 0.0 0.0 0 0</pose>
48         <inertial>
49             <mass>1</mass>
50             <pose frame='link'>0.0 0.0 0.0 0 0 0</pose>
51             <inertia>
52                 <ixx>0.0883333</ixx><!-- 1/12 * m * (h^2 + d^2) -->
53                 <ixy>0</ixy>
54                 <ixz>0</ixz>
55                 <iyy>0.0883333</iyy>

```

```

56         <iyz>0</iyz>
57         <izz>0.0416666</izz>
58     </inertia>
59 </inertial>
60 <collision name='book_collision'>
61     <geometry>
62         <box>
63             <size>0.5 0.5 0.9</size>
64         </box>
65     </geometry>
66     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
67     <surface>
68         <friction>
69             <ode>
70                 <mu>0.2</mu>
71                 <mu2>0.2</mu2>
72             </ode>
73         </friction>
74     </surface>
75 </collision>
76 <visual name='book_visual'>
77     <geometry>
78         <box>
79             <size>0.5 0.5 0.9</size>
80         </box>
81     </geometry>
82     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
83 </visual>
84 <sensor name="main_bumper" type="contact">
85     <selfCollide>true</selfCollide>
86     <alwaysOn>true</alwaysOn>
87     <updateRate>15.0</updateRate>
88     <contact>
89         <collision>book_collision</collision>
90     </contact>
91 </sensor>
92 </link>
93 <plugin name="target_tf_broadcaster" filename="
    libtf_broadcaster_plugin.so">
94     <linkName>book_link</linkName>
95     <frameName>book_object_frame</frameName>
96 </plugin>
97 <plugin name="grasp" filename="libTiltGrabPlugin.so">
98     <parentLinkName>book_link</parentLinkName>
99     <childLinkName1>left_ee::link</childLinkName1>
100    <childLinkName2>right_ee::link</childLinkName2>
101    <childLinkName3>right_ee_2::link</childLinkName3>
102    <sensorName>book_contact</sensorName>
103 </plugin>
104 </model>
105
106
107
108 <!-- Left Gripper -->
109 <include>
110     <uri>model://finger</uri>
111     <name>left_ee</name>

```

```

112     <pose>0.000000 0.000000 0.880000 0.000000 0.000000 1.57080</pose>
113
114
115     <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
116         <linkName>link</linkName>
117         <topicName>set_l_ee_twist</topicName>
118         <gains>
119             <linear>
120                 <P>100.0</P>
121                 <I>0.0</I>
122                 <D>25.0</D>
123             </linear>
124             <angular>
125                 <P>100.0</P>
126                 <I>0.0</I>
127                 <D>25.0</D>
128             </angular>
129         </gains>
130     </plugin>
131
132     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
133         <linkName>link</linkName>
134         <frameName>l_gripper_tool_frame</frameName>
135     </plugin>
136 </include>
137
138 <!-- Right Gripper -->
139 <include>
140     <uri>model://finger</uri>
141     <name>right_ee</name>
142     <pose>0.600000 0.500000 0.830000 0.000000 0.000000 1.57080</pose>
143
144     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
145         <linkName>link</linkName>
146         <topicName>set_r_ee_twist</topicName>
147         <gains>
148             <linear>
149                 <P>100.0</P>
150                 <I>0.0</I>
151                 <D>25.0</D>
152             </linear>
153             <angular>
154                 <P>100.0</P>
155                 <I>0.0</I>
156                 <D>25.0</D>
157             </angular>
158         </gains>
159     </plugin>
160
161     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
162         <linkName>link</linkName>
163         <frameName>r_gripper_tool_frame</frameName>
164     </plugin>

```



```

165     </include>
166
167     <include>
168         <uri>model://finger</uri>
169         <name>right_ee_2</name>
170         <pose>0.600000 -0.500000 0.830000 0.000000 0.000000 1.57080</pose>
171
172         <plugin name="r_2_force_controller" filename="
            libvelocity_controller_plugin.so">
173             <linkName>link</linkName>
174             <topicName>set_r_ee_2_twist</topicName>
175             <gains>
176                 <linear>
177                     <P>100.0</P>
178                     <I>0.0</I>
179                     <D>25.0</D>
180                 </linear>
181                 <angular>
182                     <P>100.0</P>
183                     <I>0.0</I>
184                     <D>25.0</D>
185                 </angular>
186             </gains>
187         </plugin>
188
189         <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
            .so">
190             <linkName>link</linkName>
191             <frameName>r_2_gripper_tool_frame</frameName>
192         </plugin>
193     </include>
194
195     <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
196
197     <gui>
198         <camera name='user_camera'>
199             <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
200             <view_controller>orbit</view_controller>
201         </camera>
202     </gui>
203
204 </world>
205 </sdf>

```

247 worlds/scooping_{bp}ot_{bs}patula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_pot_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.133471 -0.503990 0.971217 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_pot</uri>
30       <pose>0.133471 -0.503990 0.971217 0 0 0</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.079240 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43     <plugin name="l_force_controller" filename="
44       libvelocity_controller_plugin.so">
45       <linkName>link</linkName>
46       <topicName>set_l_ee_twist</topicName>
47       <gains>
48         <linear>
49           <P>100.0</P>
50           <I>0.0</I>
51           <D>25.0</D>
52         </linear>
53         <angular>
54           <P>100.0</P>
55           <I>0.0</I>

```

```

55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_spatula::link</childLinkName>
63     <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
        -3.14159</relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_pot::link</childLinkName>
98         <relativePose>0.023942 0.0237816 0.132364 -1.55141 -1.36676
            1.3834</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>
106

```

```
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116
117 </world>
118 </sdf>
```

248 worlds/scooping_{bw}ildo_bowl_{bs}patula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_wildo_bowl_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>0.078818 -0.501749 0.988186 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_wildo_bowl</uri>
30       <pose>0.078818 -0.501749 0.988186 3.097035 0 0</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.066428 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43     <plugin name="l_force_controller" filename="
44       libvelocity_controller_plugin.so">
45       <linkName>link</linkName>
46       <topicName>set_l_ee_twist</topicName>
47       <gains>
48         <linear>
49           <P>100.0</P>
50           <I>0.0</I>
51           <D>25.0</D>
52         </linear>
53         <angular>
54           <P>100.0</P>
55           <I>0.0</I>

```

```

55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_spatula::link</childLinkName>
63     <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
        -3.14159</relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_wildo_bowl::link</childLinkName>
98         <relativePose>0.0089419 0.0135799 0.0780419 1.55636 1.32285
            -1.41637</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>
106

```

```
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116
117 </world>
118 </sdf>
```

249 worlds/freezer_{box}4.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30     <include>
31         <uri>model://finger</uri>
32         <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33     </include> -->
34
35     <include>
36         <uri>model://freezer_box</uri>
37         <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38     </include>
39
40
41
42     <model name='book_target'>
43         <static>false</static>
44         <pose>0.220000 0.000000 0.300000 1.570796 0.000000 0.000000</pose>
45
46     <link name='book_link'>
47         <pose frame='link'>0.0 0.0 0.0 0.0 0 0</pose>
48         <inertial>
49             <mass>0.1</mass>
50             <pose frame='link'>0.0 0.0 0.0 0 0 0</pose>
51             <inertia>
52                 <ixx>0.002416667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
53                 <ixy>0</ixy>
54                 <ixz>0</ixz>
55                 <iyy>0.002416667</iyy>

```



```

56         <iyz>0</iyz>
57         <izz>0.004166667</izz>
58     </inertia>
59 </inertial>
60 <collision name='book_collision'>
61     <geometry>
62         <box>
63             <size>0.5 0.5 0.2</size>
64         </box>
65     </geometry>
66     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
67     <surface>
68         <friction>
69             <ode>
70                 <mu>0.2</mu>
71                 <mu2>0.2</mu2>
72             </ode>
73         </friction>
74     </surface>
75 </collision>
76 <visual name='book_visual'>
77     <geometry>
78         <box>
79             <size>0.5 0.5 0.2</size>
80         </box>
81     </geometry>
82     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
83 </visual>
84 <sensor name="main_bumper" type="contact">
85     <selfCollide>true</selfCollide>
86     <alwaysOn>true</alwaysOn>
87     <updateRate>15.0</updateRate>
88     <contact>
89         <collision>book_collision</collision>
90     </contact>
91 </sensor>
92 </link>
93 <plugin name="target_tf_broadcaster" filename="
    libtf_broadcaster_plugin.so">
94     <linkName>book_link</linkName>
95     <frameName>book_object_frame</frameName>
96 </plugin>
97 <plugin name="grasp" filename="libTiltGrabPlugin.so">
98     <parentLinkName>book_link</parentLinkName>
99     <childLinkName1>left_ee::link</childLinkName1>
100    <childLinkName2>right_ee::link</childLinkName2>
101    <childLinkName3>right_ee_2::link</childLinkName3>
102    <sensorName>book_contact</sensorName>
103 </plugin>
104 </model>
105
106
107
108 <!-- Left Gripper -->
109 <include>
110     <uri>model://finger</uri>
111     <name>left_ee</name>

```

```

112     <pose>0.000000 0.000000 0.880000 0.000000 0.000000 1.57080</pose>
113
114
115     <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
116         <linkName>link</linkName>
117         <topicName>set_l_ee_twist</topicName>
118         <gains>
119             <linear>
120                 <P>100.0</P>
121                 <I>0.0</I>
122                 <D>25.0</D>
123             </linear>
124             <angular>
125                 <P>100.0</P>
126                 <I>0.0</I>
127                 <D>25.0</D>
128             </angular>
129         </gains>
130     </plugin>
131
132     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
133         <linkName>link</linkName>
134         <frameName>l_gripper_tool_frame</frameName>
135     </plugin>
136 </include>
137
138 <!-- Right Gripper -->
139 <include>
140     <uri>model://finger</uri>
141     <name>right_ee</name>
142     <pose>0.600000 0.500000 0.830000 0.000000 0.000000 1.57080</pose>
143
144     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
145         <linkName>link</linkName>
146         <topicName>set_r_ee_twist</topicName>
147         <gains>
148             <linear>
149                 <P>100.0</P>
150                 <I>0.0</I>
151                 <D>25.0</D>
152             </linear>
153             <angular>
154                 <P>100.0</P>
155                 <I>0.0</I>
156                 <D>25.0</D>
157             </angular>
158         </gains>
159     </plugin>
160
161     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
162         <linkName>link</linkName>
163         <frameName>r_gripper_tool_frame</frameName>
164     </plugin>

```

```

165     </include>
166
167     <include>
168         <uri>model://finger</uri>
169         <name>right_ee_2</name>
170         <pose>0.600000 -0.500000 0.830000 0.000000 0.000000 1.57080</pose>
171
172         <plugin name="r_2_force_controller" filename="
            libvelocity_controller_plugin.so">
173             <linkName>link</linkName>
174             <topicName>set_r_ee_2_twist</topicName>
175             <gains>
176                 <linear>
177                     <P>100.0</P>
178                     <I>0.0</I>
179                     <D>25.0</D>
180                 </linear>
181                 <angular>
182                     <P>100.0</P>
183                     <I>0.0</I>
184                     <D>25.0</D>
185                 </angular>
186             </gains>
187         </plugin>
188
189         <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
            .so">
190             <linkName>link</linkName>
191             <frameName>r_2_gripper_tool_frame</frameName>
192         </plugin>
193     </include>
194
195     <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
196
197     <gui>
198         <camera name='user_camera'>
199             <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
200             <view_controller>orbit</view_controller>
201         </camera>
202     </gui>
203
204 </world>
205 </sdf>

```

250 worlds/grabbing_book2.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30         <include>
31             <uri>model://finger</uri>
32             <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33         </include> -->
34
35         <include>
36             <uri>model://bookshelf_</uri>
37             <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38         </include>
39
40         <!-- Books -->
41
42
43         <!--<include>
44             <uri>model://book</uri>
45             <name>book3</name>
46             <pose>0.150000 0.624000 0.475000 0.000000 0.000000 1.57080</pose>
47         </include> -->
48
49
50         <model name='book_target'>
51             <static>false</static>
52             <pose>0.150000 0.861000 0.725000 0.000000 0.000000 1.57080</pose>
53
54             <link name='book_link'>
55                 <pose frame='link'>0 0 0 0 0 0</pose>

```

```

56     <inertial>
57       <mass>0.1</mass>
58       <pose frame='link'>0 0 0 0 0 0</pose>
59       <inertia>
60         <ixx>0.00241667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
61         <ixy>0</ixy>
62         <ixz>0</ixz>
63         <iyy>0.00416667</iyy>
64         <iyz>0</iyz>
65         <izz>0.00241667</izz>
66       </inertia>
67     </inertial>
68     <collision name='book_collision'>
69       <geometry>
70         <box>
71           <size>0.5 0.2 0.5</size>
72         </box>
73       </geometry>
74       <pose frame=''>0 0 0 0 0 0</pose>
75       <surface>
76         <friction>
77           <ode>
78             <mu>0.2</mu>
79             <mu2>0.2</mu2>
80           </ode>
81         </friction>
82       </surface>
83     </collision>
84     <visual name='book_visual'>
85       <geometry>
86         <box>
87           <size>0.5 0.2 0.5</size>
88         </box>
89       </geometry>
90       <pose frame=''>0 0 0 0 0 0</pose>
91     </visual>
92     <sensor name="main_bumper" type="contact">
93       <selfCollide>true</selfCollide>
94       <alwaysOn>true</alwaysOn>
95       <updateRate>15.0</updateRate>
96       <contact>
97         <collision>book_collision</collision>
98       </contact>
99       <!--<plugin name="gazebo_ros_bumper_controller" filename="
100         libgazebo_ros_bumper.so">
101         <bumperTopicName>bumper_vals</bumperTopicName>
102         <frameName>book_target</frameName>
103       </plugin> -->
104     </sensor>
105   </link>
106   <plugin name="target_tf_broadcaster" filename="
107     libtf_broadcaster_plugin.so">
108     <linkName>book_link</linkName>
109     <frameName>book_object_frame</frameName>
110   </plugin>
111   <plugin name="grasp" filename="libTiltGrabPlugin.so">
112     <parentLinkName>book_link</parentLinkName>

```

```

111     <childLinkName1>left_ee::link</childLinkName1>
112     <childLinkName2>right_ee::link</childLinkName2>
113     <childLinkName3>right_ee_2::link</childLinkName3>
114     <sensorName>book_contact</sensorName>
115   </plugin>
116 </model>
117
118
119
120 <!-- Left Gripper -->
121 <include>
122   <uri>model://finger</uri>
123   <name>left_ee</name>
124   <pose>1.150000 0.661000 0.575000 0.000000 0.000000 1.57080</pose>
125
126
127   <plugin name="l_force_controller" filename="
128     libvelocity_controller_plugin.so">
129     <linkName>link</linkName>
130     <topicName>set_l_ee_twist</topicName>
131     <gains>
132       <linear>
133         <P>100.0</P>
134         <I>0.0</I>
135         <D>25.0</D>
136       </linear>
137       <angular>
138         <P>100.0</P>
139         <I>0.0</I>
140         <D>25.0</D>
141       </angular>
142     </gains>
143   </plugin>
144
145   <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
146     so">
147     <linkName>link</linkName>
148     <frameName>l_gripper_tool_frame</frameName>
149   </plugin>
150 </include>
151
152 <!-- Right Gripper -->
153 <include>
154   <uri>model://finger</uri>
155   <name>right_ee</name>
156   <pose>1.150000 0.600000 0.475000 0.000000 0.000000 1.57080</pose>
157
158
159   <plugin name="r_force_controller" filename="
160     libvelocity_controller_plugin.so">
161     <linkName>link</linkName>
162     <topicName>set_r_ee_twist</topicName>
163     <gains>
164       <linear>

```

```

165         <angular>
166             <P>100.0</P>
167             <I>0.0</I>
168             <D>25.0</D>
169         </angular>
170     </gains>
171 </plugin>
172
173     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
174         <linkName>link</linkName>
175         <frameName>r_gripper_tool_frame</frameName>
176     </plugin>
177 </include>
178
179 <include>
180     <uri>model://finger</uri>
181     <name>right_ee_2</name>
182     <pose>1.150000 0.700000 0.475000 0.000000 0.000000 1.57080</pose>
183
184     <plugin name="r_2_force_controller" filename="
        libvelocity_controller_plugin.so">
185         <linkName>link</linkName>
186         <topicName>set_r_ee_2_twist</topicName>
187         <gains>
188             <linear>
189                 <P>100.0</P>
190                 <I>0.0</I>
191                 <D>25.0</D>
192             </linear>
193             <angular>
194                 <P>100.0</P>
195                 <I>0.0</I>
196                 <D>25.0</D>
197             </angular>
198         </gains>
199     </plugin>
200
201     <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
        .so">
202         <linkName>link</linkName>
203         <frameName>r_2_gripper_tool_frame</frameName>
204     </plugin>
205 </include>
206
207 <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
208
209 <gui>
210     <camera name='user_camera'>
211         <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
212         <view_controller>orbit</view_controller>
213     </camera>
214 </gui>
215
216 </world>
217 </sdf>

```

251 worlds/freezer_{box}5.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3
4      <world name="grabbing_book_v">
5
6          <!-- <physics type="ode">
7              <max_step_size>0.001</max_step_size>
8              <real_time_factor>1</real_time_factor>
9              <real_time_update_rate>1000</real_time_update_rate>
10             <bullet>
11                 <solver>
12                     <iters>70</iters>
13                 </solver>
14             </bullet>
15             <ode>
16                 <solver>
17                     <iters>70</iters>
18                 </solver>
19             </ode>
20         </physics> -->
21
22         <include>
23             <uri>model://sun</uri>
24         </include>
25
26         <include>
27             <uri>model://ground_plane</uri>
28         </include>
29     <!--
30     <include>
31         <uri>model://finger</uri>
32         <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
33     </include> -->
34
35     <include>
36         <uri>model://freezer_box</uri>
37         <pose>0.000000 0.000000 0.000000 0.000000 0.000000 0.000001</pose>
38     </include>
39
40
41
42     <model name='book_target'>
43         <static>false</static>
44         <pose>0.220000 0.000000 0.300000 1.570796 0.000000 0.000000</pose>
45
46     <link name='book_link'>
47         <pose frame='link'>0.0 0.0 0.0 0.0 0 0</pose>
48         <inertial>
49             <mass>0.1</mass>
50             <pose frame='link'>0.0 0.0 0.0 0 0 0</pose>
51             <inertia>
52                 <ixx>0.004166667</ixx><!-- 1/12 * m * (h^2 + d^2) -->
53                 <ixy>0</ixy>
54                 <ixz>0</ixz>
55                 <iyy>0.002416667</iyy>

```



```

56         <iyz>0</iyz>
57         <izz>0.002416667</izz>
58     </inertia>
59 </inertial>
60 <collision name='book_collision'>
61     <geometry>
62         <box>
63             <size>0.2 0.5 0.5</size>
64         </box>
65     </geometry>
66     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
67     <surface>
68         <friction>
69             <ode>
70                 <mu>0.2</mu>
71                 <mu2>0.2</mu2>
72             </ode>
73         </friction>
74     </surface>
75 </collision>
76 <visual name='book_visual'>
77     <geometry>
78         <box>
79             <size>0.2 0.5 0.5</size>
80         </box>
81     </geometry>
82     <pose frame=''>0.0 0.0 0.0 0 0 0</pose>
83 </visual>
84 <sensor name="main_bumper" type="contact">
85     <selfCollide>true</selfCollide>
86     <alwaysOn>true</alwaysOn>
87     <updateRate>15.0</updateRate>
88     <contact>
89         <collision>book_collision</collision>
90     </contact>
91 </sensor>
92 </link>
93 <plugin name="target_tf_broadcaster" filename="
    libtf_broadcaster_plugin.so">
94     <linkName>book_link</linkName>
95     <frameName>book_object_frame</frameName>
96 </plugin>
97 <plugin name="grasp" filename="libTiltGrabPlugin.so">
98     <parentLinkName>book_link</parentLinkName>
99     <childLinkName1>left_ee::link</childLinkName1>
100    <childLinkName2>right_ee::link</childLinkName2>
101    <childLinkName3>right_ee_2::link</childLinkName3>
102    <sensorName>book_contact</sensorName>
103 </plugin>
104 </model>
105
106
107
108 <!-- Left Gripper -->
109 <include>
110     <uri>model://finger</uri>
111     <name>left_ee</name>

```

```

112     <pose>0.000000 0.000000 0.880000 0.000000 0.000000 1.57080</pose>
113
114
115     <plugin name="l_force_controller" filename="
        libvelocity_controller_plugin.so">
116         <linkName>link</linkName>
117         <topicName>set_l_ee_twist</topicName>
118         <gains>
119             <linear>
120                 <P>100.0</P>
121                 <I>0.0</I>
122                 <D>25.0</D>
123             </linear>
124             <angular>
125                 <P>100.0</P>
126                 <I>0.0</I>
127                 <D>25.0</D>
128             </angular>
129         </gains>
130     </plugin>
131
132     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
133         <linkName>link</linkName>
134         <frameName>l_gripper_tool_frame</frameName>
135     </plugin>
136 </include>
137
138 <!-- Right Gripper -->
139 <include>
140     <uri>model://finger</uri>
141     <name>right_ee</name>
142     <pose>0.600000 0.500000 0.830000 0.000000 0.000000 1.57080</pose>
143
144     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
145         <linkName>link</linkName>
146         <topicName>set_r_ee_twist</topicName>
147         <gains>
148             <linear>
149                 <P>100.0</P>
150                 <I>0.0</I>
151                 <D>25.0</D>
152             </linear>
153             <angular>
154                 <P>100.0</P>
155                 <I>0.0</I>
156                 <D>25.0</D>
157             </angular>
158         </gains>
159     </plugin>
160
161     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
162         <linkName>link</linkName>
163         <frameName>r_gripper_tool_frame</frameName>
164     </plugin>

```

```

165     </include>
166
167     <include>
168         <uri>model://finger</uri>
169         <name>right_ee_2</name>
170         <pose>0.600000 -0.500000 0.830000 0.000000 0.000000 1.57080</pose>
171
172         <plugin name="r_2_force_controller" filename="
            libvelocity_controller_plugin.so">
173             <linkName>link</linkName>
174             <topicName>set_r_ee_2_twist</topicName>
175             <gains>
176                 <linear>
177                     <P>100.0</P>
178                     <I>0.0</I>
179                     <D>25.0</D>
180                 </linear>
181                 <angular>
182                     <P>100.0</P>
183                     <I>0.0</I>
184                     <D>25.0</D>
185                 </angular>
186             </gains>
187         </plugin>
188
189         <plugin name="r_2_tf_broadcaster" filename="libtf_broadcaster_plugin
            .so">
190             <linkName>link</linkName>
191             <frameName>r_2_gripper_tool_frame</frameName>
192         </plugin>
193     </include>
194
195     <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
196
197     <gui>
198         <camera name='user_camera'>
199             <pose>1.770789 1.775709 1.500612 0 0.375643 -2.675000</pose>
200             <view_controller>orbit</view_controller>
201         </camera>
202     </gui>
203
204 </world>
205 </sdf>

```

252 worlds/scraping_{br}ed_mug_bkni_fe_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_red_mug_b_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_knife</uri>
15       <pose>0.090993 0.503448 0.999041 -1.609842 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.200479 1.549194 2.743074</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_red_mug</uri>
30       <pose>0.061612 -0.504614 1.006537 0.423677 0 3.060068</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_knife::link</childLinkName>
59         <relativePose>0.090993 0.003448 -0.000959 -1.60984 0 0</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
            libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_red_mug::link</childLinkName>
94         <relativePose>-0.00780861 0.00428533 0.0614876 1.24173 -1.34456
            1.65836</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
            libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

253 worlds/scraping_bfrying_pan_bspatula_p.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_frying_pan_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.461945 1.549196 2.743082</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_frying_pan</uri>
30       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://grripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_position_controller" filename="
40         libposition_controller_plugin.so">
41         <linkName>link</linkName>
42         <referenceFrameName>base_link</referenceFrameName>
43         <targetFrameName>l_grripper_tool_frame</targetFrameName>
44         <P>0.0</P>
45         <I>0.0</I>
46         <D>0.0</D>
47       </plugin>
48
49       <plugin name="l_grip" filename="libGripPlugin.so">
50         <parentLinkName>link</parentLinkName>
51         <childLinkName>b_spatula::link</childLinkName>
52         <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
53           -3.14159</relativePose>
54       </plugin>

```

```

54     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
55         <linkName>link</linkName>
56         <frameName>l_gripper_tool_frame</frameName>
57     </plugin>
58 </include>
59
60 <!-- Right Gripper -->
61 <include>
62     <uri>model://gripper</uri>
63     <name>right_ee</name>
64     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
65
66     <plugin name="r_position_controller" filename="
        libposition_controller_plugin.so">
67         <linkName>link</linkName>
68         <referenceFrameName>base_link</referenceFrameName>
69         <targetFrameName>r_gripper_tool_frame</targetFrameName>
70         <P>100.0</P>
71         <I>0.0</I>
72         <D>50.0</D>
73     </plugin>
74
75     <plugin name="r_grip" filename="libGripPlugin.so">
76         <parentLinkName>link</parentLinkName>
77         <childLinkName>b_frying_pan::link</childLinkName>
78         <relativePose>0.0186144 0.0468562 0.224672 -1.55141 -1.36676
            1.3834</relativePose>
79     </plugin>
80
81     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
82         <linkName>link</linkName>
83         <frameName>r_gripper_tool_frame</frameName>
84     </plugin>
85 </include>
86
87 <plugin name="feature_visualization_plugin" filename="
        libgiskard_visualization_plugin.so"></plugin>
88
89 <gui>
90     <camera name='user_camera'>
91         <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
92         <view_controller>orbit</view_controller>
93     </camera>
94 </gui>
95
96 </world>
97 </sdf>

```


254 worlds/scraping_{bbig}owl_{bs}patula_p.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="scraping">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.140489 0.527566 0.997957 1.571605 -0.058101 -2.939758</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.208221 0.534198 0.991390 1.634659 1.569999 -0.001148</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_big_bowl</uri>
30       <pose>0.024164 -0.383989 0.959287 -0.017186 -0.000884 -0.101566</
31         pose>
32     </include>
33
34     <!-- Left Gripper -->
35     <include>
36       <uri>model://gripper</uri>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_position_controller" filename="
40         libposition_controller_plugin.so">
41         <linkName>link</linkName>
42         <referenceFrameName>base_link</referenceFrameName>
43         <targetFrameName>l_gripper_tool_frame</targetFrameName>
44         <P>0.0</P>
45         <I>0.0</I>
46         <D>0.0</D>
47       </plugin>
48
49       <plugin name="l_grip" filename="libGripPlugin.so">
50         <parentLinkName>link</parentLinkName>
51         <childLinkName>b_spatula::link</childLinkName>
52         <relativePose>0.14 0.028 -0.002 -1.57 3.20 0.20</relativePose>
53       </plugin>
54     </include>
55   </world>
56 </sdf>
57 </xml>

```

```

54     <!-- Right Gripper -->
55     <include>
56         <uri>model://gripper</uri>
57         <pose>0 -0.5 1 0 0 0</pose>
58
59         <plugin name="r_position_controller" filename="
60             libposition_controller_plugin.so">
61             <linkName>link</linkName>
62             <referenceFrameName>base_link</referenceFrameName>
63             <targetFrameName>r_gripper_tool_frame</targetFrameName>
64             <P>100.0</P>
65             <I>0.0</I>
66             <D>50.0</D>
67         </plugin>
68
69         <plugin name="r_grip" filename="libGripPlugin.so">
70             <parentLinkName>link</parentLinkName>
71             <childLinkName>b_big_bowl::link</childLinkName>
72             <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
73         </plugin>
74     </include>
75
76     <gui>
77         <camera name='user_camera'>
78             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
79             <view_controller>orbit</view_controller>
80         </camera>
81     </gui>
82
83 </world>
84 </sdf>

```

255 worlds/scraping_{bp}ot_{bs}patula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_pot_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.146581 0.505236 0.992013 1.576128 -0.007193 -3.141592</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.461945 1.549196 2.743082</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_spatula::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_pot</uri>
30       <pose>0.133471 -0.503990 0.971217 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_spatula::link</childLinkName>
59         <relativePose>0.146581 0.005236 -0.007987 1.57613 -0.007193
        -3.14159</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_pot::link</childLinkName>
94         <relativePose>0.023942 0.0237816 0.132364 -1.55141 -1.36676
        1.3834</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104
105 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```

256 worlds/scraping_{bb}bucket_{bk}knife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_bucket_b_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_knife</uri>
15       <pose>0.090993 0.503448 0.999041 -1.609842 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.226360 0.495670 0.996721 1.200479 1.549194 2.743074</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_bucket</uri>
30       <pose>0.100858 -0.510180 0.939254 -3.128475 -0.140461 3.129033</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_knife::link</childLinkName>
59         <relativePose>0.090993 0.003448 -0.000959 -1.60984 0 0</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
            libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_bucket::link</childLinkName>
94         <relativePose>0.0577053 0.0189525 0.101375 2.17015 1.31252
            2.31211</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
            so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
            libgiskard_visualization_plugin.so"></plugin>
104

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```


257 worlds/scraping_bfrying_pan_bserving_sspoon_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_frying_pan_b_serving_spoon_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_serving_spoon</uri>
15       <pose>0.112572 0.508131 0.984633 1.382835 0.015399 0.080779</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.198795 0.509112 0.981783 3.036336 1.368174 -1.866245</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_serving_spoon::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_frying_pan</uri>
30       <pose>0.228443 -0.496122 0.971397 0 0 0</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43         <gains>
44           <linear>
45             <P>100.0</P>
46             <I>0.0</I>
47             <D>25.0</D>
48           </linear>
49           <angular>
50             <P>100.0</P>
51             <I>0.0</I>
52             <D>25.0</D>
53           </angular>
54         </gains>
55       </plugin>

```

```

55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_serving_spoon::link</childLinkName>
59         <relativePose>0.112571612 0.00813051871955 -0.0153673645109
            1.3828344221275815 0.015398730956486372 0.08077832485708741</
            relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
63         <linkName>link</linkName>
64         <frameName>l_gripper_tool_frame</frameName>
65     </plugin>
66 </include>
67
68 <!-- Right Gripper -->
69 <include>
70     <uri>model://gripper</uri>
71     <name>right_ee</name>
72     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
73
74     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
75         <linkName>link</linkName>
76         <topicName>set_r_ee_twist</topicName>
77         <gains>
78             <linear>
79                 <P>100.0</P>
80                 <I>0.0</I>
81                 <D>25.0</D>
82             </linear>
83             <angular>
84                 <P>100.0</P>
85                 <I>0.0</I>
86                 <D>25.0</D>
87             </angular>
88         </gains>
89     </plugin>
90
91     <plugin name="r_grip" filename="libGripPlugin.so">
92         <parentLinkName>link</parentLinkName>
93         <childLinkName>b_frying_pan::link</childLinkName>
94         <relativePose>0.0186144 0.0468562 0.224672 -1.55141 -1.36676
            1.3834</relativePose>
95     </plugin>
96
97     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
98         <linkName>link</linkName>
99         <frameName>r_gripper_tool_frame</frameName>
100    </plugin>
101 </include>
102
103 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
104

```

```
105         <gui>
106             <camera name='user_camera'>
107                 <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108                 <view_controller>orbit</view_controller>
109             </camera>
110         </gui>
111
112     </world>
113 </sdf>
```

258 worlds/scraping_{bb}bucket_{bt}able_kknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_bucket_b_table_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_table_knife</uri>
15       <pose>0.060878 0.497562 1.005864 1.616805 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.135713 0.488941 1.003983 0.274231 1.507716 1.875637</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_table_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_bucket</uri>
30       <pose>0.100858 -0.510180 0.939254 -3.128475 -0.140461 3.129033</pose>
31     </include>
32
33     <!-- Left Gripper -->
34     <include>
35       <uri>model://gripper</uri>
36       <name>left_ee</name>
37       <pose>0 0.5 1 0 0 0</pose>
38
39       <plugin name="l_force_controller" filename="
40         libvelocity_controller_plugin.so">
41         <linkName>link</linkName>
42         <topicName>set_l_ee_twist</topicName>
43       </plugin>
44
45       <plugin name="l_grip" filename="libGripPlugin.so">
46         <parentLinkName>link</parentLinkName>
47         <childLinkName>b_table_knife::link</childLinkName>
48         <relativePose>0.060878 -0.002438 0.005864 1.6168 0 0</relativePose>
49       </plugin>
50
51       <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
52         so">
53         <linkName>link</linkName>

```

```

52         <frameName>l_gripper_tool_frame</frameName>
53     </plugin>
54 </include>
55
56 <!-- Right Gripper -->
57 <include>
58     <uri>model://gripper</uri>
59     <name>right_ee</name>
60     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
61
62     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
63         <linkName>link</linkName>
64         <topicName>set_r_ee_twist</topicName>
65     </plugin>
66
67     <plugin name="r_grip" filename="libGripPlugin.so">
68         <parentLinkName>link</parentLinkName>
69         <childLinkName>b_bucket::link</childLinkName>
70         <relativePose>0.0577053 0.0189525 0.101375 2.17015 1.31252
            2.31211</relativePose>
71     </plugin>
72
73     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
74         <linkName>link</linkName>
75         <frameName>r_gripper_tool_frame</frameName>
76     </plugin>
77 </include>
78
79 <plugin name="feature_visualization_plugin" filename="
    libgiskard_visualization_plugin.so"></plugin>
80
81 <gui>
82     <camera name='user_camera'>
83         <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
84         <view_controller>orbit</view_controller>
85     </camera>
86 </gui>
87
88 </world>
89 </sdf>

```

259 worlds/scraping_{bbig}owl_{bt}able_kknife_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_big_bowl_b_table_knife_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_table_knife</uri>
15       <pose>0.060878 0.497562 1.005864 1.616805 0 0</pose>
16     </include>
17
18     <include>
19       <uri>model://butter_box</uri>
20       <pose>0.135713 0.488941 1.003983 0.274231 1.507716 1.875637</pose>
21       <plugin name="stick" filename="libStickPlugin.so">
22         <parentLinkName>link</parentLinkName>
23         <childLinkName>b_table_knife::link</childLinkName>
24         <force>5</force>
25       </plugin>
26     </include>
27
28     <include>
29       <uri>model://b_big_bowl</uri>
30       <pose>0.024164 -0.383989 0.959287 -0.017186 -0.000884 -0.101566</
31         pose>
32     </include>
33
34     <!-- Left Gripper -->
35     <include>
36       <uri>model://gripper</uri>
37       <name>left_ee</name>
38       <pose>0 0.5 1 0 0 0</pose>
39
40       <plugin name="l_force_controller" filename="
41         libvelocity_controller_plugin.so">
42         <linkName>link</linkName>
43         <topicName>set_l_ee_twist</topicName>
44         <gains>
45           <linear>
46             <P>100.0</P>
47             <I>0.0</I>
48             <D>25.0</D>
49           </linear>
50           <angular>
51             <P>100.0</P>
52             <I>0.0</I>
53             <D>25.0</D>
54           </angular>
55         </gains>

```

```

54     </plugin>
55
56     <plugin name="l_grip" filename="libGripPlugin.so">
57         <parentLinkName>link</parentLinkName>
58         <childLinkName>b_table_knife::link</childLinkName>
59         <relativePose>0.060878 -0.002438 0.005864 1.6168 0 0</relativePose>
60     </plugin>
61
62     <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
63         so">
64         <linkName>link</linkName>
65         <frameName>l_gripper_tool_frame</frameName>
66     </plugin>
67 </include>
68
69 <!-- Right Gripper -->
70 <include>
71     <uri>model://gripper</uri>
72     <name>right_ee</name>
73     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
74
75     <plugin name="r_force_controller" filename="
76         libvelocity_controller_plugin.so">
77         <linkName>link</linkName>
78         <topicName>set_r_ee_twist</topicName>
79         <gains>
80             <linear>
81                 <P>100.0</P>
82                 <I>0.0</I>
83                 <D>25.0</D>
84             </linear>
85             <angular>
86                 <P>100.0</P>
87                 <I>0.0</I>
88                 <D>25.0</D>
89             </angular>
90         </gains>
91     </plugin>
92
93     <plugin name="r_grip" filename="libGripPlugin.so">
94         <parentLinkName>link</parentLinkName>
95         <childLinkName>b_big_bowl::link</childLinkName>
96         <relativePose>0.06 0.11 0 -1.57 -1.35 1.3</relativePose>
97     </plugin>
98
99     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
100         so">
101         <linkName>link</linkName>
102         <frameName>r_gripper_tool_frame</frameName>
103     </plugin>
104 </include>
105
106 <plugin name="feature_visualization_plugin" filename="
107     libgiskard_visualization_plugin.so"></plugin>
108
109 <gui>

```

```
106         <camera name='user_camera'>
107             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
108             <view_controller>orbit</view_controller>
109         </camera>
110     </gui>
111
112 </world>
113 </sdf>
```


260 worlds/scooping_{bc}of_{fee}cup_{bs}patula_v.world

```

1  <?xml version='1.0'?>
2  <sdf version="1.6">
3    <world name="b_coffee_cup_b_spatula_v">
4
5      <include>
6        <uri>model://sun</uri>
7      </include>
8
9      <include>
10       <uri>model://ground_plane</uri>
11     </include>
12
13     <include>
14       <uri>model://b_spatula</uri>
15       <pose>0.094321 0.507657 1.009274 -1.637236 0.074980 -3.141592</pose>
16     </include>
17
18     <plugin name="grains_factory" filename="libGrainsFactoryPlugin.so">
19       <pose>-0.016492 -0.468631 0.965206 0 0 0</pose>
20       <mass>0.001</mass>
21       <radius>0.015</radius>
22       <quantity>100</quantity>
23       <friction>0.4</friction>
24       <friction2>0.4</friction2>
25       <velocity_decay>0.3</velocity_decay>
26     </plugin>
27
28     <include>
29       <uri>model://b_coffee_cup</uri>
30       <pose>-0.016492 -0.468631 0.965206 2.603069 -1.513021 -2.66073</pose>
31     </include>
32
33     <include>
34       <uri>model://table</uri>
35       <pose>0.021929 0.062805 -0.085745 0 0 -1.571974</pose>
36     </include>
37     <!-- Left Gripper -->
38     <include>
39       <uri>model://gripper</uri>
40       <name>left_ee</name>
41       <pose>0 0.5 1 0 0 0</pose>
42
43       <plugin name="l_force_controller" filename="
44         libvelocity_controller_plugin.so">
45         <linkName>link</linkName>
46         <topicName>set_l_ee_twist</topicName>
47         <gains>
48           <linear>
49             <P>100.0</P>
50             <I>0.0</I>
51             <D>25.0</D>
52           </linear>
53           <angular>

```

```

54         <I>0.0</I>
55         <D>25.0</D>
56     </angular>
57 </gains>
58 </plugin>
59
60 <plugin name="l_grip" filename="libGripPlugin.so">
61     <parentLinkName>link</parentLinkName>
62     <childLinkName>b_thin_spatula::link</childLinkName>
63     <relativePose>0.094321 0.007657 0.009274 -1.63724 0.07498
        -3.14159</relativePose>
64 </plugin>
65
66 <plugin name="l_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
67     <linkName>link</linkName>
68     <frameName>l_gripper_tool_frame</frameName>
69 </plugin>
70 </include>
71
72 <!-- Right Gripper -->
73 <include>
74     <uri>model://gripper</uri>
75     <name>right_ee</name>
76     <pose>0 -0.5 1 1.547368 1.402341 1.343703</pose>
77
78     <plugin name="r_force_controller" filename="
        libvelocity_controller_plugin.so">
79         <linkName>link</linkName>
80         <topicName>set_r_ee_twist</topicName>
81         <gains>
82             <linear>
83                 <P>100.0</P>
84                 <I>0.0</I>
85                 <D>25.0</D>
86             </linear>
87             <angular>
88                 <P>100.0</P>
89                 <I>0.0</I>
90                 <D>25.0</D>
91             </angular>
92         </gains>
93     </plugin>
94
95     <plugin name="r_grip" filename="libGripPlugin.so">
96         <parentLinkName>link</parentLinkName>
97         <childLinkName>b_coffee_cup::link</childLinkName>
98         <relativePose>0.0284501 0.0346428 -0.0213798 2.93848 0.00496188
            2.88401</relativePose>
99     </plugin>
100
101     <plugin name="r_tf_broadcaster" filename="libtf_broadcaster_plugin.
        so">
102         <linkName>link</linkName>
103         <frameName>r_gripper_tool_frame</frameName>
104     </plugin>
105 </include>

```

```

106
107     <plugin name="feature_visualization_plugin" filename="
108         libgiskard_visualization_plugin.so"></plugin>
109
110     <gui>
111         <camera name='user_camera'>
112             <pose>1.700789 1.175709 1.670612 0 0.375643 -2.675000</pose>
113             <view_controller>orbit</view_controller>
114         </camera>
115     </gui>
116 </world>
117 </sdf>

```

261 src/giskard_adapter.cpp

```

1  #include "skill_transfer/giskard_adapter.h"
2  #include "skill_transfer/conversions.h"
3  #include "skill_transfer/giskard_utils.h"
4  #include "skill_transfer/giskard_viz.h"
5
6  GiskardAdapter::GiskardAdapter(int nWSR) : nWSR_(nWSR)
7  {
8  }
9
10 void GiskardAdapter::createController(const std::string &constraints)
11 {
12     controller_started_ = false;
13     controller_ = generateController(constraints);
14 }
15
16 void GiskardAdapter::startController(const Eigen::VectorXd &inputs)
17 {
18     if (!controller_started_)
19     {
20         if (!controller_.start(inputs, nWSR_))
21         {
22             throw std::runtime_error("Failed to start controller");
23         }
24
25         controller_started_ = true;
26     }
27     else
28     {
29         ROS_WARN("GiskardAdapter: Attempt to start an active controller");
30     }
31 }
32
33 void GiskardAdapter::updateController(const Eigen::VectorXd &inputs)
34 {
35     if (!controller_.update(inputs, nWSR_))
36     {
37         throw std::runtime_error("Failed to update controller");
38     }
39 }
40
41 geometry_msgs::Twist GiskardAdapter::getDesiredFrameTwistMsg(
42     const Eigen::VectorXd &inputs,
43     const std::string &frame_name)
44 {
45     const Eigen::VectorXd desired_velocity =
46         getJacobian(controller_, frame_name, inputs).data * controller_.
47         get_command();
48     return eigenVectorToMsgTwist(desired_velocity);
49 }
50
51 sensor_msgs::JointState GiskardAdapter::getDesiredJointVelocityMsg()
52 {
53     return eigenVectorToMsgJointState(controller_.get_command());
54 }

```

```

55
56 geometry_msgs::Twist GiskardAdapter::getMeasuredFrameTwistMsg(
57     const Eigen::VectorXd &inputs,
58     const Eigen::VectorXd &velocities,
59     const std::string &frame_name)
60 {
61     return eigenVectorToMsgTwist(getJacobian(controller_, frame_name, inputs).data
        * velocities);
62 }
63
64 double GiskardAdapter::getDistance()
65 {
66     const KDL::Expression<KDL::Vector>::Ptr distance_exp =
67         controller_.get_scope().find_vector_expression("distance");
68     auto distance_vector = distance_exp->value();
69     double distance = distance_vector.Norm();
70
71     return distance;
72 }
73
74 std::vector<visualization_msgs::Marker> GiskardAdapter::getVisualizationMsgs()
75 {
76     return std::vector<visualization_msgs::Marker>{
77         createPointMarker(controller_, "tool-point", "base_footprint"),
78         createPointMarker(controller_, "target-object-point", "base_footprint"),
79         createPointDirectionMarker(controller_, "tool-point", "distance", "
            base_footprint")};
80 }

```

262 src/constraint_controller_free_es.cpp

```

1  #include <ros/ros.h>
2  #include <actionlib/server/simple_action_server.h>
3  #include <skill_transfer/MoveArmAction.h>
4  #include <geometry_msgs/Twist.h>
5  #include <gazebo_msgs/LinkStates.h>
6  #include <visualization_msgs/Marker.h>
7  #include <giskard_core/giskard_core.hpp>
8  #include "skill_transfer/conversions.h"
9  #include "skill_transfer/giskard_adapter.h"
10 #include <vector>
11 #include <string>
12 #include <algorithm>
13
14 class ConstraintController
15 {
16 public:
17     ConstraintController(std::string name) : as_(nh_, name, false),
18                                             action_name_(name),
19                                             giskard_adapter_(100)
20     {
21         //register the goal and feedback callbacks
22         as_.registerGoalCallback(boost::bind(&ConstraintController::onGoal, this));
23         as_.registerPreemptCallback(boost::bind(&ConstraintController::onPreempt,
24         this));
25
26         //subscribe to the data topic of interest
27         sub_ = nh_.subscribe("/gazebo/link_states", 1, &ConstraintController::
28         onLinkStatesMsg, this);
29
30         // Topic for simulation and executive node, since they only
31         // care about the end effector velocity and not about joint velocities
32         pub_l_ee_ = nh_.advertise<geometry_msgs::Twist>("/l_ee_twist", 1);
33         pub_set_l_ee_ = nh_.advertise<geometry_msgs::Twist>("/set_l_ee_twist", 1);
34         pub_r_ee_ = nh_.advertise<geometry_msgs::Twist>("/r_ee_twist", 1);
35         pub_set_r_ee_ = nh_.advertise<geometry_msgs::Twist>("/set_r_ee_twist", 1);
36         pub_r_ee_2_ = nh_.advertise<geometry_msgs::Twist>("/r_ee_2_twist", 1);
37         pub_set_r_ee_2_ = nh_.advertise<geometry_msgs::Twist>("/set_r_ee_2_twist",
38         1);
39
40         // Desired motion state visualization for RViz
41         pub_viz_ = nh_.advertise<visualization_msgs::Marker>("/giskard/
42         visualization_marker", 10);
43
44         as_.start();
45     }
46
47 ~ConstraintController()
48 {
49 }
50
51 void onGoal()
52 {
53     // Accept goal and get new constraints
54     const auto goal = as_.acceptNewGoal();
55     constraints_ = goal->constraints;
56
57     ROS_INFO("%s: Received a new goal", action_name_.c_str());
58 }

```

```

52
53     giskard_adapter_.createController(constraints_);
54 }
55
56 void onPreempt()
57 {
58     ROS_INFO("%s:␣Preempted", action_name_.c_str());
59     // set the action state to preempted
60     as_.setPreempted();
61 }
62
63 void onLinkStatesMsg(const gazebo_msgs::LinkStatesConstPtr &msg)
64 {
65     // Link state map
66     auto link_pose_map = toMap<std::string, geometry_msgs::Pose>(msg->name, msg
        ->pose);
67     auto link_twist_map = toMap<std::string, geometry_msgs::Twist>(msg->name,
        msg->twist);
68
69     const auto left_ee_pose = link_pose_map.find("left_ee::link")->second;
70     const auto left_ee_twist = link_twist_map.find("left_ee::link")->second;
71     const auto right_ee_pose = link_pose_map.find("right_ee::link")->second;
72     const auto right_ee_twist = link_twist_map.find("right_ee::link")->second;
73     const auto right_ee_2_pose = link_pose_map.find("right_ee_2::link")->second;
74     const auto right_ee_2_twist = link_twist_map.find("right_ee_2::link")->
        second;
75
76     // When action is not active send zero twist,
77     // otherwise do all the calculations
78     if (as_.isActive())
79     {
80         // Prepare controller inputs
81         Eigen::VectorXd inputs(18);
82         inputs.segment(0, 6) = msgPoseToEigenVector(left_ee_pose);
83         inputs.segment(6, 6) = msgPoseToEigenVector(right_ee_pose);
84         inputs.segment(12, 6) = msgPoseToEigenVector(right_ee_2_pose);
85
86         // Start the controller if it's a new one
87         if (!giskard_adapter_.controller_started_)
88         {
89             giskard_adapter_.startController(inputs);
90         }
91
92         // Get new calculations from the controller
93         giskard_adapter_.updateController(inputs);
94
95         const auto l_ee_twist_desired_msg = giskard_adapter_.
            getDesiredFrameTwistMsg(inputs, "left_ee");
96         const auto r_ee_twist_desired_msg = giskard_adapter_.
            getDesiredFrameTwistMsg(inputs, "right_ee");
97         const auto r_ee_2_twist_desired_msg = giskard_adapter_.
            getDesiredFrameTwistMsg(inputs, "right_ee_2");
98
99         pub_set_l_ee_.publish(l_ee_twist_desired_msg);
100        pub_l_ee_.publish(left_ee_twist);
101        pub_set_r_ee_.publish(r_ee_twist_desired_msg);
102        pub_r_ee_.publish(right_ee_twist);

```

```

103     pub_set_r_ee_2_.publish(r_ee_2_twist_desired_msg);
104     pub_r_ee_2_.publish(right_ee_2_twist);
105
106     feedback_.distance = giskard_adapter_.getDistance();
107     as_.publishFeedback(feedback_);
108
109     // Visualization
110     const auto viz_msgs = giskard_adapter_.getVisualizationMsgs();
111
112     for (const auto &m : viz_msgs)
113     {
114         pub_viz_.publish(m);
115     }
116 }
117 else
118 {
119     const geometry_msgs::Twist cmd;
120     pub_set_l_ee_.publish(cmd);
121     pub_set_r_ee_.publish(cmd);
122     pub_set_r_ee_2_.publish(cmd);
123 }
124
125 // ROS_INFO_STREAM("Twist: " << cmd.twist);
126 }
127
128 protected:
129     ros::NodeHandle nh_;
130     actionlib::SimpleActionServer<skill_transfer::MoveArmAction> as_;
131     std::string action_name_;
132     ros::Subscriber sub_;
133     ros::Publisher pub_l_ee_;
134     ros::Publisher pub_set_l_ee_;
135     ros::Publisher pub_r_ee_;
136     ros::Publisher pub_set_r_ee_;
137     ros::Publisher pub_r_ee_2_;
138     ros::Publisher pub_set_r_ee_2_;
139     ros::Publisher pub_viz_;
140     std::string constraints_;
141     skill_transfer::MoveArmFeedback feedback_;
142     GiskardAdapter giskard_adapter_;
143 };
144
145 int main(int argc, char **argv)
146 {
147     ros::init(argc, argv, "constraint_controller");
148
149     ConstraintController controller("move_arm");
150     ros::spin();
151
152     return 0;
153 }

```


263 src/twist_log.cpp

```

1  #include "skill_transfer/twist_log.h"
2  #include <algorithm>
3  #include <cmath>
4
5  TwistLog::TwistLog(unsigned int size) : size_(size)
6  {
7  }
8
9  void TwistLog::push(geometry_msgs::Twist twist)
10 {
11     // Keep the log size fixed by removing the oldest entry
12     if (log_.size() >= size_)
13         log_.pop_front();
14
15     // Save twist to log
16     log_.push_back(twist);
17 }
18
19 void TwistLog::clear()
20 {
21     log_.clear();
22 }
23
24 bool TwistLog::allFilledAndBelowThreshold(double threshold)
25 {
26     // Log has to be filled up
27     if (log_.size() < size_)
28         return false;
29
30     return std::all_of(log_.begin(), log_.end(),
31                        [threshold](const geometry_msgs::Twist &t) {
32                            return (std::abs(t.linear.x) < threshold) &&
33                                   (std::abs(t.linear.y) < threshold) &&
34                                   (std::abs(t.linear.z) < threshold) &&
35                                   (std::abs(t.angular.x) < threshold) &&
36                                   (std::abs(t.angular.y) < threshold) &&
37                                   (std::abs(t.angular.z) < threshold);
38                        });
39 }

```

264 src/knowledge_manager.cpp

```

1  #include <ros/ros.h>
2  #include <yaml-cpp/yaml.h>
3  #include <vector>
4  #include <utility>
5  #include <string>
6  #include <boost/filesystem.hpp>
7  #include <boost/filesystem/fstream.hpp>
8  #include <tf2_ros/static_transform_broadcaster.h>
9
10 #include <skill_transfer/StopCondition.h>
11 #include <skill_transfer/GetTaskSpec.h>
12 #include <skill_transfer/GetMotionSpec.h>
13 #include <skill_transfer/DetectTargetObjectInfo.h>
14 #include <skill_transfer/DetectToolInfo.h>
15
16 class KnowledgeManager
17 {
18 private:
19     // Possible internal states of the node
20     enum State
21     {
22         Created,
23         Initialized,
24         Waiting,
25         ProcessingKnowledge,
26         Ready
27     };
28     // State
29     State state_ = State::Created;
30     // ROS handles
31     ros::NodeHandle node_handle_;
32     ros::ServiceClient target_object_info_service_client_;
33     ros::ServiceClient tool_info_service_client_;
34     ros::ServiceServer task_spec_service_server_;
35     ros::ServiceServer motion_spec_service_server_;
36     // File paths
37     std::string task_file_path_;
38     std::string setup_file_path_;
39     std::string motion_template_file_path_;
40     // File directories
41     std::string motion_directory_path_;
42     std::string info_cache_directory_path_;
43     // YAML files
44     YAML::Node setup_;
45     YAML::Node task_;
46     YAML::Node motion_template_;
47     // TF2
48     tf2_ros::StaticTransformBroadcaster tf_broadcaster_;
49
50 public:
51     KnowledgeManager() : node_handle_("~")
52     {
53         // Load values from ROSParam
54
55         if (!node_handle_.getParam("task_file_path", task_file_path_))

```

```

56     {
57         throw std::runtime_error("Could not find parameter 'task_file_path' in
            namespace '" +
58                                     node_handle_.getNamespace() + "'.");
59     }
60
61     if (!node_handle_.getParam("setup_file_path", setup_file_path_))
62     {
63         throw std::runtime_error("Could not find parameter 'setup_file_path' in
            namespace '" +
64                                     node_handle_.getNamespace() + "'.");
65     }
66
67     if (!node_handle_.getParam("motion_template_file_path",
            motion_template_file_path_))
68     {
69         throw std::runtime_error("Could not find parameter '
            motion_template_file_path' in namespace '" +
70                                     node_handle_.getNamespace() + "'.");
71     }
72
73     if (!node_handle_.getParam("motion_directory_path", motion_directory_path_))
74     {
75         throw std::runtime_error("Could not find parameter 'motion_directory_path'
            in namespace '" +
76                                     node_handle_.getNamespace() + "'.");
77     }
78
79     if (!node_handle_.getParam("info_cache_directory_path",
            info_cache_directory_path_))
80     {
81         throw std::runtime_error("Could not find parameter '
            info_cache_directory_path' in namespace '" +
82                                     node_handle_.getNamespace() + "'.");
83     }
84
85     // Load files
86     try
87     {
88         setup_ = YAML::LoadFile(setup_file_path_);
89     }
90     catch (const std::exception &e)
91     {
92         ROS_ERROR("Could not load setup file");
93         throw;
94     }
95
96     try
97     {
98         task_ = YAML::LoadFile(task_file_path_);
99     }
100    catch (const std::exception &e)
101    {
102        ROS_ERROR("Could not load task file");
103        throw;
104    }
105

```

```

106     try
107     {
108         motion_template_ = YAML::LoadFile(motion_template_file_path_);
109     }
110     catch (const std::exception &e)
111     {
112         ROS_ERROR("Could not load motion template file");
113         throw;
114     }
115
116     // Initialize servers and clients
117     target_object_info_service_client_ =
118         node_handle_.serviceClient<skill_transfer::DetectTargetObjectInfo>("/
        feature_detector/detect_target_object_info");
119
120     tool_info_service_client_ =
121         node_handle_.serviceClient<skill_transfer::DetectToolInfo>("/
        feature_detector/detect_tool_info");
122
123     state_ = State::Initialized;
124 }
125
126 void start()
127 {
128     ROS_ASSERT(state_ == State::Initialized);
129
130     state_ = State::Waiting;
131
132     target_object_info_service_client_.waitForExistence();
133     tool_info_service_client_.waitForExistence();
134
135     state_ = State::ProcessingKnowledge;
136
137     // Broadcast grasps on TF
138     broadcastGrasps();
139
140     // Requesting info from detector
141
142     // Check if cache exist
143     const std::string &target_object_ply_name = setup_["point-clouds"]["target-
        object"].as<std::string>();
144     const std::string &tool_ply_name = setup_["point-clouds"]["tool"].as<std::
        string>();
145
146     if (cachedInfoExists(target_object_ply_name, tool_ply_name))
147     {
148         loadCachedInfo(target_object_ply_name, tool_ply_name);
149     }
150     else
151     {
152         // Target object info
153         if (task_["required-object-info"]["target-object"].as<bool>())
154         {
155             callDetectTargetObjectInfo();
156         }
157
158         // Tool info

```

```

159     if (task_["required-object-info"]["tool"].as<bool>())
160     {
161         callDetectToolInfo();
162     }
163
164     saveCachedInfo(target_object_ply_name, tool_ply_name);
165 }
166
167 // Starting services
168 task_spec_service_server_ =
169     node_handle_.advertiseService("get_task_spec",
170                                   &KnowledgeManager::serveGetTaskSpec,
171                                   this);
172 motion_spec_service_server_ =
173     node_handle_.advertiseService("get_motion_spec",
174                                   &KnowledgeManager::serveGetMotionSpec,
175                                   this);
176
177 state_ = State::Ready;
178 }
179
180 bool serveGetMotionSpec(skill_transfer::GetMotionSpec::Request &req,
181                         skill_transfer::GetMotionSpec::Response &res)
182 {
183     ROS_ASSERT(state_ == State::Ready);
184
185     std::size_t index = req.index; // implicit type conversion
186     res.stop_condition = getMotionStopCondition(index);
187     res.spec = getMotionSpec(index);
188
189     // ROS_INFO_STREAM(res.spec);
190
191     return true;
192 }
193
194 bool serveGetTaskSpec(skill_transfer::GetTaskSpec::Request &req,
195                      skill_transfer::GetTaskSpec::Response &res)
196 {
197     ROS_ASSERT(state_ == State::Ready);
198
199     res.motion_phase_count = getMotionCount(); // implicit type conversion
200
201     return true;
202 }
203
204 private:
205 /**
206  * Makes a service call to feature_detector and saves returned values.
207  */
208 void callDetectTargetObjectInfo()
209 {
210     skill_transfer::DetectTargetObjectInfo srv;
211
212     srv.request.point_cloud_file_name =
213         setup_["point-clouds"]["target-object"].as<std::string>();
214
215     if (!target_object_info_service_client_.call(srv))

```

```

216     {
217         throw std::runtime_error("Failed to call service detect_target_object_info
218     ");
219     }
220     YAML::Node point_node;
221     point_node["vector3"].push_back(srv.response.edge_point.x);
222     point_node["vector3"].push_back(srv.response.edge_point.y);
223     point_node["vector3"].push_back(srv.response.edge_point.z);
224
225     setup_["object-info"]["edge-point"] = point_node;
226
227     YAML::Node vector_node;
228     vector_node["vector3"].push_back(srv.response.alignment_vector.x);
229     vector_node["vector3"].push_back(srv.response.alignment_vector.y);
230     vector_node["vector3"].push_back(srv.response.alignment_vector.z);
231
232     setup_["object-info"]["alignment-vector"] = vector_node;
233 }
234
235 void callDetectToolInfo()
236 {
237     skill_transfer::DetectToolInfo srv;
238
239     srv.request.point_cloud_file_name =
240         setup_["point-clouds"]["tool"].as<std::string>();
241
242     srv.request.task_name = task_["required-object-info"]["task"].as<std::string>();
243
244     srv.request.tool_mass = setup_["tool-mass"].as<double>();
245
246     srv.request.edge_point.x = setup_["object-info"]["edge-point"]["vector3"]
247         [0].as<double>();
248     srv.request.edge_point.y = setup_["object-info"]["edge-point"]["vector3"]
249         [1].as<double>();
250     srv.request.edge_point.z = setup_["object-info"]["edge-point"]["vector3"]
251         [2].as<double>();
252
253     srv.request.alignment_vector.x = setup_["object-info"]["alignment-vector"]["vector3"]
254         [0].as<double>();
255     srv.request.alignment_vector.y = setup_["object-info"]["alignment-vector"]["vector3"]
256         [1].as<double>();
257     srv.request.alignment_vector.z = setup_["object-info"]["alignment-vector"]["vector3"]
258         [2].as<double>();
259
260     if (!tool_info_service_client_.call(srv))
261     {
262         throw std::runtime_error("Failed to call service detect_target_object_info
263     ");
264     }
265
266     YAML::Node grasp_node;
267     grasp_node["vector3"].push_back(srv.response.grasp_center.x);
268     grasp_node["vector3"].push_back(srv.response.grasp_center.y);
269     grasp_node["vector3"].push_back(srv.response.grasp_center.z);
270

```

```

264     setup_["object-info"]["grasp-center"] = grasp_node;
265
266     YAML::Node center_node;
267     center_node["vector3"].push_back(srv.response.action_center.x);
268     center_node["vector3"].push_back(srv.response.action_center.y);
269     center_node["vector3"].push_back(srv.response.action_center.z);
270
271     setup_["object-info"]["action-center"] = center_node;
272
273     YAML::Node tip_node;
274     tip_node["vector3"].push_back(srv.response.tool_tip.x);
275     tip_node["vector3"].push_back(srv.response.tool_tip.y);
276     tip_node["vector3"].push_back(srv.response.tool_tip.z);
277
278     setup_["object-info"]["tool-tip"] = tip_node;
279
280     YAML::Node tip_vector_node;
281     tip_vector_node["vector3"].push_back(srv.response.tool_tip_vector.x);
282     tip_vector_node["vector3"].push_back(srv.response.tool_tip_vector.y);
283     tip_vector_node["vector3"].push_back(srv.response.tool_tip_vector.z);
284
285     setup_["object-info"]["tool-tip-vector"] = tip_vector_node;
286
287     YAML::Node orientation_node;
288     orientation_node["quaternion"].push_back(srv.response.tool_quaternion.x);
289     orientation_node["quaternion"].push_back(srv.response.tool_quaternion.y);
290     orientation_node["quaternion"].push_back(srv.response.tool_quaternion.z);
291     orientation_node["quaternion"].push_back(srv.response.tool_quaternion.w);
292
293     setup_["object-info"]["tool-quaternion"] = orientation_node;
294
295     YAML::Node heel_node;
296     heel_node["vector3"].push_back(srv.response.tool_heel.x);
297     heel_node["vector3"].push_back(srv.response.tool_heel.y);
298     heel_node["vector3"].push_back(srv.response.tool_heel.z);
299
300     setup_["object-info"]["tool-heel"] = heel_node;
301 }
302
303 std::size_t getMotionCount() const
304 {
305     return task_["motion-phases"].size();
306 }
307
308 /**
309  * Reads motion YAML file, combines it with
310  * motion template YAML file and
311  * fills in the gaps, i. e. grasps, object features.
312  * Returns the spec as a string.
313  *
314  * @return string Complete motion phase spec.
315  */
316 std::string getMotionSpec(std::size_t index) const
317 {
318     ROS_ASSERT(index >= 0 && index < task_["motion-phases"].size());
319
320     YAML::Node phase = task_["motion-phases"][index];

```

```

321
322 // Read the motion phase file
323 boost::filesystem::path dir_path(motion_directory_path_);
324 std::string file_path = phase["file"].as<std::string>();
325 const boost::filesystem::path path = dir_path / file_path;
326
327 if (!boost::filesystem::exists(path))
328 {
329     throw std::runtime_error("File not found: " + path.string());
330 }
331
332 const YAML::Node phase_spec = YAML::LoadFile(path.string());
333 YAML::Node motion_spec = YAML::Clone(motion_template_);
334
335 // Merge the template and the motion spec
336 const YAML::Node motion_spec_scope = motion_spec["scope"];
337 const YAML::Node scope = phase_spec["scope"];
338 const YAML::Node constraints = phase_spec["soft-constraints"];
339
340 // Fill in grasps
341 // They have to be put in front of the scope, so we
342 // make a new scope and re-add things
343 YAML::Node new_scope;
344
345 YAML::Node tool_grasp_node;
346 tool_grasp_node["tool-grasp"] = setup_["tool-grasp"];
347 YAML::Node target_object_grasp_node;
348 target_object_grasp_node["target-object-grasp"] = setup_["target-object-
    grasp"];
349 YAML::Node target_object_grasp_2_node;
350 target_object_grasp_2_node["target-object-grasp-2"] = setup_["target-object-
    grasp-2"];
351
352 YAML::Node object_width_node;
353 YAML::Node object_width_2_node;
354 double width;
355 width = setup_["object-width"].as<double>();
356 object_width_node["object-width"] = (width / 2) + 0.04;
357 object_width_2_node["object-width-2"] = -((width / 2) + 0.04);
358 new_scope.push_back(tool_grasp_node);
359 new_scope.push_back(target_object_grasp_node);
360 new_scope.push_back(target_object_grasp_2_node);
361 new_scope.push_back(object_width_node);
362 new_scope.push_back(object_width_2_node);
363
364 // Fill in object features
365 const YAML::Node &all_features_node = setup_["object-info"];
366
367 for (YAML::const_iterator it = all_features_node.begin(); it !=
    all_features_node.end(); ++it)
368 {
369     YAML::Node fn;
370     fn[it->first] = it->second;
371
372     new_scope.push_back(fn);
373 }
374
375 // Fill in template scope

```



```

375     for (YAML::const_iterator it = motion_spec_scope.begin(); it !=
376           motion_spec_scope.end(); ++it)
377     {
378         new_scope.push_back(*it);
379     }
380     // Fill in the phase scope
381     for (YAML::const_iterator it = scope.begin(); it != scope.end(); ++it)
382     {
383         new_scope.push_back(*it);
384     }
385     // Replace scope
386     motion_spec["scope"] = new_scope;
387     // Insert constraints
388     motion_spec["soft-constraints"] = constraints;
389
390     // Convert spec to string
391     YAML::Emitter out;
392     out << motion_spec;
393     std::string spec{out.c_str()};
394
395     return spec;
396 }
397
398 skill_transfer::StopCondition getMotionStopCondition(std::size_t index) const
399 {
400     ROS_ASSERT(index >= 0 && index < task_["motion-phases"].size());
401
402     const YAML::Node &node = task_["motion-phases"][index]["stop"];
403     skill_transfer::StopCondition msg;
404
405     try
406     {
407     {
408         msg.measured_velocity_min = node["measured-velocity-min-threshold"].as<
409             double>();
410         msg.desired_velocity_min = node["desired-velocity-min-threshold"].as<
411             double>();
412         msg.contact = node["contact"].as<bool>();
413         msg.activation_distance = node["activation-distance"].as<double>();
414     }
415     catch (std::exception &e)
416     {
417         ROS_ERROR("Failed to parse stop condition");
418         throw;
419     }
420     return msg;
421 }
422 void broadcastGrasps()
423 {
424     // Broadcast grasps on TF
425     {
426         const auto &tool_grasp_frame = setup_["target-object-grasp"]["frame"];
427         double qx, qy, qz, qw, x, y, z;
428

```

```

429     for (const auto &n : tool_grasp_frame)
430     {
431         if (n["quaternion"])
432         {
433             const auto &q = n["quaternion"];
434
435             qx = q[0].as<double>();
436             qy = q[1].as<double>();
437             qz = q[2].as<double>();
438             qw = q[3].as<double>();
439         }
440
441         if (n["vector3"])
442         {
443             const auto &v = n["vector3"];
444
445             x = v[0].as<double>();
446             y = v[1].as<double>();
447             z = v[2].as<double>();
448         }
449     }
450
451     geometry_msgs::TransformStamped transform_stamped;
452
453     transform_stamped.header.frame_id = "r_gripper_tool_frame";
454     transform_stamped.child_frame_id = "target_object_frame";
455     transform_stamped.header.stamp = ros::Time::now();
456
457     transform_stamped.transform.translation.x = x;
458     transform_stamped.transform.translation.y = y;
459     transform_stamped.transform.translation.z = z;
460     transform_stamped.transform.rotation.x = qx;
461     transform_stamped.transform.rotation.y = qy;
462     transform_stamped.transform.rotation.z = qz;
463     transform_stamped.transform.rotation.w = qw;
464
465     tf_broadcaster_.sendTransform(transform_stamped);
466 }
467 {
468     const auto &tool_grasp_frame = setup_["target-object-grasp-2"]["frame"];
469     double qx, qy, qz, qw, x, y, z;
470
471     for (const auto &n : tool_grasp_frame)
472     {
473         if (n["quaternion"])
474         {
475             const auto &q = n["quaternion"];
476
477             qx = q[0].as<double>();
478             qy = q[1].as<double>();
479             qz = q[2].as<double>();
480             qw = q[3].as<double>();
481         }
482
483         if (n["vector3"])
484         {
485             const auto &v = n["vector3"];

```

```

486
487     x = v[0].as<double>();
488     y = v[1].as<double>();
489     z = v[2].as<double>();
490 }
491 }
492
493 geometry_msgs::TransformStamped transform_stamped;
494
495 transform_stamped.header.frame_id = "r_gripper_tool_frame";
496 transform_stamped.child_frame_id = "target-object-grasp-2";
497 transform_stamped.header.stamp = ros::Time::now();
498
499 transform_stamped.transform.translation.x = x;
500 transform_stamped.transform.translation.y = y;
501 transform_stamped.transform.translation.z = z;
502 transform_stamped.transform.rotation.x = qx;
503 transform_stamped.transform.rotation.y = qy;
504 transform_stamped.transform.rotation.z = qz;
505 transform_stamped.transform.rotation.w = qw;
506
507 tf_broadcaster_.sendTransform(transform_stamped);
508 }
509 {
510     const auto &tool_grasp_frame = setup_["tool-grasp"]["frame"];
511     double qx, qy, qz, qw, x, y, z;
512
513     for (const auto &n : tool_grasp_frame)
514     {
515         if (n["quaternion"])
516         {
517             const auto &q = n["quaternion"];
518
519             qx = q[0].as<double>();
520             qy = q[1].as<double>();
521             qz = q[2].as<double>();
522             qw = q[3].as<double>();
523         }
524
525         if (n["vector3"])
526         {
527             const auto &v = n["vector3"];
528
529             x = v[0].as<double>();
530             y = v[1].as<double>();
531             z = v[2].as<double>();
532         }
533     }
534
535     geometry_msgs::TransformStamped transform_stamped;
536
537     transform_stamped.header.frame_id = "l_gripper_tool_frame";
538     transform_stamped.child_frame_id = "tool_frame";
539     transform_stamped.header.stamp = ros::Time::now();
540
541     transform_stamped.transform.translation.x = x;
542     transform_stamped.transform.translation.y = y;

```

```

543     transform_stamped.transform.translation.z = z;
544     transform_stamped.transform.rotation.x = qx;
545     transform_stamped.transform.rotation.y = qy;
546     transform_stamped.transform.rotation.z = qz;
547     transform_stamped.transform.rotation.w = qw;
548
549     tf_broadcaster_.sendTransform(transform_stamped);
550 }
551 }
552
553 bool cachedInfoExists(const std::string &target_object_ply_name,
554                      const std::string &tool_ply_name)
555 {
556     const boost::filesystem::path target_object_ply_path{target_object_ply_name
557     };
558     const boost::filesystem::path tool_ply_path{tool_ply_name};
559
560     std::string cache_file_name = target_object_ply_path.stem().string() +
561     "_" + tool_ply_path.stem().string();
562
563     boost::filesystem::path dir_path(info_cache_directory_path_);
564     const boost::filesystem::path path = dir_path / (cache_file_name + ".yaml");
565
566     if (!boost::filesystem::exists(path))
567     {
568         return false;
569     }
570
571     return true;
572 }
573
574 void loadCachedInfo(const std::string &target_object_ply_name,
575                   const std::string &tool_ply_name)
576 {
577     const boost::filesystem::path target_object_ply_path{target_object_ply_name
578     };
579     const boost::filesystem::path tool_ply_path{tool_ply_name};
580
581     std::string cache_file_name = target_object_ply_path.stem().string() +
582     "_" + tool_ply_path.stem().string();
583
584     boost::filesystem::path dir_path(info_cache_directory_path_);
585     const boost::filesystem::path path = dir_path / (cache_file_name + ".yaml");
586
587     if (!boost::filesystem::exists(path))
588     {
589         throw std::runtime_error("File not found: " + path.string());
590     }
591
592     const YAML::Node info_node = YAML::LoadFile(path.string());
593     setup_["object-info"] = info_node;
594
595     ROS_INFO_STREAM("SETUP:\n"
596     << setup_["object-info"]);
597 }
598
599 void saveCachedInfo(const std::string &target_object_ply_name,

```

```

598         const std::string &tool_ply_name)
599     {
600         const YAML::Node &all_features_node = setup_["object-info"];
601
602         const boost::filesystem::path target_object_ply_path{target_object_ply_name
603             };
604         const boost::filesystem::path tool_ply_path{tool_ply_name};
605
606         std::string cache_file_name = target_object_ply_path.stem().string() +
607             "_" + tool_ply_path.stem().string();
608
609         boost::filesystem::path dir_path(info_cache_directory_path_);
610         const boost::filesystem::path path = dir_path / (cache_file_name + ".yaml");
611
612         YAML::Emitter emitter;
613         emitter << all_features_node;
614
615         std::ofstream fout(path.c_str());
616         fout << emitter.c_str();
617     }
618 };
619
620 int main(int argc, char **argv)
621 {
622     ros::init(argc, argv, "knowledge_manager");
623     KnowledgeManager manager;
624     manager.start();
625     ros::spin();
626
627     return 0;
628 }

```

265 src/feature_detector.cpp

```

1  #include <ros/ros.h>
2  #include <tf2_ros/transform_listener.h>
3  #include <tf/transform_datatypes.h>
4  #include <geometry_msgs/Point.h>
5  #include <boost/format.hpp>
6  #include <fstream>
7  #include <map>
8
9  #include <skill_transfer/DetectTargetObjectInfo.h>
10 #include <skill_transfer/DetectToolInfo.h>
11
12 class FeatureDetector
13 {
14 private:
15     // ROS handles
16     ros::NodeHandle node_handle_;
17     ros::ServiceServer tool_info_service_server_;
18     ros::ServiceServer target_object_info_service_server_;
19     // File directories
20     std::string point_cloud_directory_path_;
21     std::string trained_data_directory_path_;
22     // TF
23     tf2_ros::Buffer tfBuffer;
24     tf2_ros::TransformListener tfListener;
25     std::map<std::string, std::string> name2frame_;
26     // Additional parameters
27     bool show_results_ = false;
28
29 public:
30     FeatureDetector() : node_handle_("~"),
31                        tfListener(tfBuffer)
32     {
33         // Initialize name -> frame map
34         name2frame_["tool"] = "tool_frame";
35         name2frame_["target-object"] = "target_object_frame";
36
37         if (!node_handle_.getParam("point_cloud_directory_path",
38                                     point_cloud_directory_path_))
39         {
40             throw std::runtime_error("Could not find parameter 'point_cloud_directory_path' in namespace '" +
41                                     node_handle_.getNamespace() + "'.");
42         }
43
44         if (!node_handle_.getParam("trained_data_directory_path",
45                                     trained_data_directory_path_))
46         {
47             throw std::runtime_error("Could not find parameter 'trained_data_directory_path' in namespace '" +
48                                     node_handle_.getNamespace() + "'.");
49         }
50
51         node_handle_.getParam("show_results", show_results_);
52
53         // Start services

```

```

52     tool_info_service_server_ = node_handle_.advertiseService("detect_tool_info"
53         ,
54         , &FeatureDetector::
55           serveDetectToolInfo
56           ,
57           this);
58     target_object_info_service_server_ = node_handle_.advertiseService("
59       detect_target_object_info",
60       ,
61       &
62         FeatureDetector
63         ::
64         serveDetectTargetObjectInfo
65         ,
66         this);
67 }
68
69 bool serveDetectTargetObjectInfo(skill_transfer::DetectTargetObjectInfo::
70   Request &req,
71   skill_transfer::DetectTargetObjectInfo::
72   Response &res)
73 {
74     // Find reference point
75     const geometry_msgs::TransformStamped transform_stamped = findTransform("
76       target-object", "tool");
77     const geometry_msgs::Vector3 reference_point = transform_stamped.transform.
78       translation;
79
80     const std::string &point_cloud_file_name = req.point_cloud_file_name;
81     const std::string point_cloud_path = point_cloud_directory_path_ +
82       point_cloud_file_name;
83
84     std::string display_options = "";
85
86     display_options = show_results_ ? "1 1" : "";
87
88     const auto command =
89       boost::format("run_get_target_obj_info.sh /usr/local/MATLAB/
90         MATLAB_Runtime/v93 %1 %2 [%3 %4] \" %5 > /tmp/
91         target_object_info.txt") %
92       point_cloud_path % reference_point.x % reference_point.y %
93       reference_point.z % display_options;
94
95     ROS_INFO_STREAM("Command: " << command);
96
97     std::system(command.str().c_str());
98
99     std::ifstream file("/tmp/target_object_info.txt");
100
101     for (std::string line; std::getline(file, line);)
102     {
103         if (line.empty())
104             continue;
105
106         if (line.find("target_obj_contact_points") == 0)
107         {
108             std::getline(file, line);
109             std::istringstream line_iss(line);

```

```

93
94     // read point
95     line_iss >> res.edge_point.x;
96     line_iss >> res.edge_point.y;
97     line_iss >> res.edge_point.z;
98 }
99
100 if (line.find("target_obj_align_vecs") == 0)
101 {
102     std::getline(file, line);
103     std::istringstream line_iss(line);
104
105     // read point
106     line_iss >> res.alignment_vector.x;
107     line_iss >> res.alignment_vector.y;
108     line_iss >> res.alignment_vector.z;
109 }
110 }
111
112 ROS_INFO_STREAM("Target_Object_Info:\n"
113                 << res);
114
115 return true;
116 }
117
118 bool serveDetectToolInfo(skill_transfer::DetectToolInfo::Request &req,
119                          skill_transfer::DetectToolInfo::Response &res)
120 {
121     const std::string &point_cloud_file_name = req.point_cloud_file_name;
122     const std::string point_cloud_path = point_cloud_directory_path_ +
123                                         point_cloud_file_name;
124
125     const std::string trained_data_file_name = req.task_name + ".mat";
126     const std::string trained_data_path = trained_data_directory_path_ +
127                                         trained_data_file_name;
128
129     std::string display_options = show_results_ ? "1 1" : "";
130
131     // Rotate alignment vector
132     // const geometry_msgs::TransformStamped target_2_tool_transform_msg =
133     //     findTransform("target-object", "tool");
134     // tf::Transform target_2_tool_transform;
135     // tf::Vector3 alignvector;
136     // tf::transformMsgToTF(target_2_tool_transform_msg.transform,
137     //                       target_2_tool_transform);
138     // tf::vector3MsgToTF(req.alignment_vector, alignvector);
139     // tf::Vector3 transformed_vector = target_2_tool_transform(alignvector);
140
141     const auto command =
142         boost::format("run_get_tool_info.sh %s/usr/local/MATLAB/MATLAB_Runtime/v93
143                       %1% %2% \"[%3%;%4%;%5%]\" \"%6% %7% %8%\" \"%9% %10% %11%> %/tmp/
144                       tool_info.txt") %
145         point_cloud_path %
146         req.tool_mass %
147         req.alignment_vector.x %
148         req.alignment_vector.y %
149         req.alignment_vector.z %

```



```

144     req.edge_point.x %
145     req.edge_point.y %
146     req.edge_point.z %
147     req.task_name %
148     trained_data_path %
149     display_options;
150
151 ROS_INFO_STREAM("Command:␣" << command);
152
153 std::system(command.str().c_str());
154
155 std::ifstream file("/tmp/tool_info.txt");
156
157 for (std::string line; std::getline(file, line);)
158 {
159     ROS_INFO_STREAM(line);
160
161     if (line.empty())
162         continue;
163
164     if (line.find("affordance_score") == 0)
165     {
166         std::getline(file, line);
167         std::istringstream line_iss(line);
168
169         // read number
170         line_iss >> res.affordance_score;
171     }
172
173     if (line.find("grasp_center") == 0)
174     {
175         std::getline(file, line);
176         std::istringstream line_iss(line);
177
178         // read point
179         line_iss >> res.grasp_center.x;
180         line_iss >> res.grasp_center.y;
181         line_iss >> res.grasp_center.z;
182     }
183
184     if (line.find("action_center") == 0)
185     {
186         std::getline(file, line);
187         std::istringstream line_iss(line);
188
189         // read point
190         line_iss >> res.action_center.x;
191         line_iss >> res.action_center.y;
192         line_iss >> res.action_center.z;
193     }
194
195     if (line.find("tool_tip_vector") == 0)
196     {
197         std::getline(file, line);
198         std::istringstream line_iss(line);
199
200         // read point

```

```

201     line_iss >> res.tool_tip_vector.x;
202     line_iss >> res.tool_tip_vector.y;
203     line_iss >> res.tool_tip_vector.z;
204 }
205
206 if (line.find("tool_tip") == 0)
207 {
208     std::getline(file, line);
209     std::istringstream line_iss(line);
210
211     // read point
212     line_iss >> res.tool_tip.x;
213     line_iss >> res.tool_tip.y;
214     line_iss >> res.tool_tip.z;
215 }
216
217 if (line.find("tool_quaternion") == 0)
218 {
219     std::getline(file, line);
220     std::istringstream line_iss(line);
221
222     // read point
223     line_iss >> res.tool_quaternion.w;
224     line_iss >> res.tool_quaternion.x;
225     line_iss >> res.tool_quaternion.y;
226     line_iss >> res.tool_quaternion.z;
227 }
228
229 if (line.find("tool_heel") == 0)
230 {
231     std::getline(file, line);
232     std::istringstream line_iss(line);
233
234     // read point
235     line_iss >> res.tool_heel.x;
236     line_iss >> res.tool_heel.y;
237     line_iss >> res.tool_heel.z;
238 }
239 }
240
241 // ROS_INFO_STREAM("Before: \n" << res.tool_quaternion << "\n");
242
243 // // Transform quaternion
244 // const geometry_msgs::TransformStamped tool_2_target_transform_msg =
245 //     findTransform("tool", "target-object");
246 // tf::Transform tool_2_target_transform;
247 // tf::Quaternion tool_quaternion;
248 // tf::transformMsgToTF(tool_2_target_transform_msg.transform,
249 //     tool_2_target_transform);
250 // tf::quaternionMsgToTF(res.tool_quaternion, tool_quaternion);
251
252 // tf::Quaternion transformed_quaternion = tool_2_target_transform *
253 //     tool_quaternion;
254
255 // tf::quaternionTFToMsg(transformed_quaternion, res.tool_quaternion);
256
257 ROS_INFO_STREAM("Tool Info:\n")

```

```

255         << res);
256
257     return true;
258 }
259
260 private:
261     geometry_msgs::TransformStamped findTransform(std::string object, std::string
        reference)
262     {
263         std::string object_frame = name2frame_[object];
264         std::string reference_frame = name2frame_[reference];
265
266         geometry_msgs::TransformStamped transform_stamped;
267
268         try
269         {
270             transform_stamped = tfBuffer.lookupTransform(
271                 object_frame, reference_frame, ros::Time(0), ros::Duration(10.0));
272         }
273         catch (tf2::TransformException &ex)
274         {
275             ROS_ERROR("Reference point lookup failed");
276             throw;
277         }
278
279         return transform_stamped;
280     }
281 };
282
283 int main(int argc, char **argv)
284 {
285     ros::init(argc, argv, "feature_detector");
286
287     FeatureDetector detector;
288     ros::spin();
289
290     return 0;
291 }

```

266 src/constraint_controller_pr2.cpp

```

1  #include <ros/ros.h>
2  #include <actionlib/server/simple_action_server.h>
3  #include <skill_transfer/MoveArmAction.h>
4  #include <geometry_msgs/Twist.h>
5  #include <sensor_msgs/JointState.h>
6  #include <visualization_msgs/Marker.h>
7  #include <giskard_core/giskard_core.hpp>
8  #include "skill_transfer/conversions.h"
9  #include "skill_transfer/giskard_adapter.h"
10 #include <vector>
11 #include <string>
12 #include <algorithm>
13 #include "skill_transfer/watchdog.hpp"
14
15 class ConstraintController
16 {
17 public:
18     ConstraintController(std::string name) : as_(nh_, name, false),
19                                             action_name_(name),
20                                             giskard_adapter_(100)
21     {
22         joint_names_ = {
23             "torso_lift_joint",
24             "l_shoulder_pan_joint",
25             "l_shoulder_lift_joint",
26             "l_upper_arm_roll_joint",
27             "l_elbow_flex_joint",
28             "l_forearm_roll_joint",
29             "l_wrist_flex_joint",
30             "l_wrist_roll_joint",
31             "r_shoulder_pan_joint",
32             "r_shoulder_lift_joint",
33             "r_upper_arm_roll_joint",
34             "r_elbow_flex_joint",
35             "r_forearm_roll_joint",
36             "r_wrist_flex_joint",
37             "r_wrist_roll_joint"};
38
39         //register the goal and feedback callbacks
40         as_.registerGoalCallback(boost::bind(&ConstraintController::onGoal, this));
41         as_.registerPreemptCallback(boost::bind(&ConstraintController::onPreempt,
42         this));
43
44         //subscribe to the data topic of interest
45         sub_ = nh_.subscribe("/joint_states", 1, &ConstraintController::
46         onJointStatesMsg, this,
47         ros::TransportHints().tcpNoDelay());
48
49         // Topic for real PR2 commands (joint velocities)
50         pub_ = nh_.advertise<sensor_msgs::JointState>("/whole_body_controller/
51         velocity_controller/command", 1);
52         // Topic for simulation and executive node, since they only
53         // care about the end effector velocity and not about joint velocities
54         pub_gripper_ = nh_.advertise<geometry_msgs::Twist>("/set_l_ee_twist", 1);
55         pub_gripper_measured_ = nh_.advertise<geometry_msgs::Twist>("/l_ee_twist",

```

```

1);
53 // Desired motion state visualization for RViz
54 pub_viz_ = nh_.advertise<visualization_msgs::Marker>("/giskard/
    visualization_marker", 1);
55
56 watchdog_.setPeriod(ros::Duration(0.1));
57
58 as_.start();
59 }
60
61 ~ConstraintController()
62 {
63 }
64
65 void onGoal()
66 {
67     // Accept goal and get new constraints
68     const auto goal = as_.acceptNewGoal();
69     constraints_ = goal->constraints;
70
71     ROS_INFO("%s: Received a new goal", action_name_.c_str());
72
73     giskard_adapter_.createController(constraints_);
74     watchdog_.kick(ros::Time::now());
75 }
76
77 void onPreempt()
78 {
79     ROS_INFO("%s: Preempted", action_name_.c_str());
80     // set the action state to preempted
81     as_.setPreempted();
82 }
83
84 void onJointStatesMsg(const sensor_msgs::JointStateConstPtr &msg)
85 {
86     if (watchdog_.barking(msg->header.stamp))
87     {
88         // ROS_INFO("BARKING");
89         return;
90     }
91
92     // Link state map
93     auto joint_positions_map = toMap<std::string, double>(msg->name, msg->
        position);
94     auto joint_velocities_map = toMap<std::string, double>(msg->name, msg->
        velocity);
95
96     auto joint_count = joint_names_.size();
97
98     // When action is not active send zero twist,
99     // otherwise do all the calculations
100     if (as_.isActive())
101     {
102         // Prepare controller inputs
103
104         Eigen::VectorXd inputs(joint_count);
105

```

```

106     for (int i = 0; i < joint_count; ++i)
107     {
108         inputs(i) = joint_positions_map.find(joint_names_[i])->second;
109     }
110
111     Eigen::VectorXd velocities(joint_count);
112
113     for (int i = 0; i < joint_count; ++i)
114     {
115         velocities(i) = joint_velocities_map.find(joint_names_[i])->second;
116     }
117
118     // Start the controller if it's a new one
119     if (!giskard_adapter_.controller_started_)
120     {
121         giskard_adapter_.startController(inputs);
122     }
123
124     // Get new calculations from the controller
125     giskard_adapter_.updateController(inputs);
126
127     const auto ee_twist_desired = giskard_adapter_.getDesiredFrameTwistMsg(
128         inputs, "left_ee");
129     const auto ee_twist_measured = giskard_adapter_.getMeasuredFrameTwistMsg(
130         inputs, velocities, "left_ee");
131     const auto cmd = giskard_adapter_.getDesiredJointVelocityMsg();
132
133     // ROS_INFO_STREAM("ee_twist_desired" << ee_twist_desired);
134
135     pub_.publish(cmd);
136     pub_gripper_.publish(ee_twist_desired);
137     pub_gripper_measured_.publish(ee_twist_measured);
138
139     feedback_.distance = giskard_adapter_.getDistance();
140     as_.publishFeedback(feedback_);
141
142     // Visualization
143     const auto viz_msgs = giskard_adapter_.getVisualizationMsgs();
144
145     for (const auto &m : viz_msgs)
146     {
147         pub_viz_.publish(m);
148     }
149     else
150     {
151         Eigen::VectorXd velocities(joint_count);
152
153         for (int i = 0; i < joint_count; ++i)
154         {
155             velocities(i) = 0.0;
156         }
157
158         auto cmd = eigenVectorToMsgJointState(velocities);
159         pub_.publish(cmd);
160     }

```

```

161
162     watchdog_.kick(ros::Time::now());
163     // ROS_INFO_STREAM("Twist: " << cmd.twist);
164 }
165
166 protected:
167     ros::NodeHandle nh_;
168     actionlib::SimpleActionServer<skill_transfer::MoveArmAction> as_;
169     std::string action_name_;
170     ros::Subscriber sub_;
171     ros::Publisher pub_;
172     ros::Publisher pub_gripper_;
173     ros::Publisher pub_gripper_measured_;
174     ros::Publisher pub_viz_;
175     std::string constraints_;
176     skill_transfer::MoveArmFeedback feedback_;
177     GiskardAdapter giskard_adapter_;
178     std::vector<std::string> joint_names_;
179     giskard_ros::Watchdog<ros::Time, ros::Duration> watchdog_;
180 };
181
182 int main(int argc, char **argv)
183 {
184     ros::init(argc, argv, "constraint_controller");
185
186     ConstraintController controller("move_arm");
187     ros::spin();
188
189     return 0;
190 }

```

267 src/task_executive.cpp

```

1  #include <ros/ros.h>
2  #include <actionlib/client/simple_action_client.h>
3  #include <actionlib/client/terminal_state.h>
4  #include <geometry_msgs/Twist.h>
5  #include <gazebo_msgs/ContactsState.h>
6
7  #include <skill_transfer/StopCondition.h>
8  #include <skill_transfer/GetTaskSpec.h>
9  #include <skill_transfer/GetMotionSpec.h>
10 #include <skill_transfer/MoveArmAction.h>
11
12 #include "skill_transfer/twist_log.h"
13
14 class TaskExecutive
15 {
16 private:
17     // Possible internal states of the node
18     enum State
19     {
20         Created,
21         Initialized,
22         Waiting,
23         ObtainingTaskSpec,
24         Ready,
25         ObtainingMotionSpec,
26         Running,
27         Stopped,
28         Finished
29     };
30     // State
31     State state_ = State::Created;
32     // ROS handles
33     ros::NodeHandle node_handle_;
34     ros::Subscriber ee_twist_subscriber_;
35     ros::Subscriber set_ee_twist_subscriber_;
36     ros::Subscriber r_ee_twist_subscriber_;
37     ros::Subscriber set_r_ee_twist_subscriber_;
38     ros::Subscriber r_ee_2_twist_subscriber_;
39     ros::Subscriber set_r_ee_2_twist_subscriber_;
40     ros::Subscriber tool_contact_subscriber_;
41     ros::ServiceClient task_spec_service_client_;
42     ros::ServiceClient motion_spec_service_client_;
43     actionlib::SimpleActionClient<skill_transfer::MoveArmAction>
        constraint_action_server_;
44     // Motion control variables
45     int phase_count_;
46     int phase_index_;
47     TwistLog velocity_log_;
48     TwistLog command_log_;
49     double goal_distance_;
50     skill_transfer::StopCondition stop_condition_;
51     std::string spec_;
52
53 public:
54     TaskExecutive() : node_handle_("~/"),

```



```

55         constraint_action_server_("move_arm", true),
56         velocity_log_(10),
57         command_log_(10)
58     {
59         ee_twist_subscriber_ = node_handle_.subscribe("/l_ee_twist", 1,
60                                                     &TaskExecutive::onEeTwistMsg,
61                                                     this);
62         set_ee_twist_subscriber_ = node_handle_.subscribe("/set_l_ee_twist", 1,
63                                                         &TaskExecutive::
64                                                         onSetEeTwistMsg, this);
65
66         r_ee_twist_subscriber_ = node_handle_.subscribe("/r_ee_twist", 1,
67                                                         &TaskExecutive::onEeTwistMsg,
68                                                         this);
69         set_r_ee_twist_subscriber_ = node_handle_.subscribe("/set_r_ee_twist", 1,
70                                                         &TaskExecutive::
71                                                         onSetEeTwistMsg, this);
72
73         r_ee_2_twist_subscriber_ = node_handle_.subscribe("/r_ee_2_twist", 1,
74                                                         &TaskExecutive::onEeTwistMsg,
75                                                         this);
76         set_r_ee_2_twist_subscriber_ = node_handle_.subscribe("/set_r_ee_2_twist",
77                                                         1,
78                                                         &TaskExecutive::
79                                                         onSetEeTwistMsg, this);
80
81         tool_contact_subscriber_ = node_handle_.subscribe("/
82                                                         tool_contact_sensor_state", 1,
83                                                         &TaskExecutive::
84                                                         onToolContactSensorStateMsg
85                                                         , this);
86
87         task_spec_service_client_ = node_handle_.serviceClient<skill_transfer::
88             GetTaskSpec>("/knowledge_manager/get_task_spec");
89         motion_spec_service_client_ = node_handle_.serviceClient<skill_transfer::
90             GetMotionSpec>("/knowledge_manager/get_motion_spec");
91
92         state_ = State::Initialized;
93     }
94
95     void start()
96     {
97         ROS_ASSERT(state_ == State::Initialized);
98
99         // Wait for the 3rd parties
100        state_ = State::Waiting;
101
102        task_spec_service_client_.waitForExistence();
103        motion_spec_service_client_.waitForExistence();
104        constraint_action_server_.waitForServer();
105
106        // Obtain the number of phases
107        state_ = State::ObtainingTaskSpec;
108
109        skill_transfer::GetTaskSpec srv;
110
111        if (!task_spec_service_client_.call(srv))

```

```

100     {
101         throw std::runtime_error("Failed to call service get_task_spec");
102     }
103
104     phase_count_ = srv.response.motion_phase_count;
105
106     state_ = State::Ready;
107
108     ROS_INFO("Press any key to begin the motion");
109
110     //std::getchar();
111
112     // Start the motion
113     startPhase(0);
114 }
115
116 void onEeTwistMsg(const geometry_msgs::TwistConstPtr &msg)
117 {
118     if (state_ != State::Running)
119     {
120         return;
121     }
122
123     // Save twist to log
124     velocity_log_.push(*msg);
125
126     checkMeasuredVelocityStop();
127 }
128
129 void onSetEeTwistMsg(const geometry_msgs::TwistConstPtr &msg)
130 {
131     // Do not track velocities until the motion starts
132     if (state_ != State::Running)
133     {
134         return;
135     }
136
137     // Save twist to log
138     command_log_.push(*msg);
139
140     checkDesiredVelocityStop();
141 }
142
143 void onToolContactSensorStateMsg(const gazebo_msgs::ContactsStatePtr
144                                 &msg)
145 {
146     // Do not track contact until the motion starts
147     if (state_ != State::Running)
148     {
149         return;
150     }
151
152     // Continue only when there's a contact
153     if (msg->states.size() == 0)
154         return;
155
156     checkContactStop();

```

```

157 }
158
159 void onFinish(const actionlib::SimpleClientGoalState &state,
160              const skill_transfer::MoveArmResultConstPtr &result)
161 {
162     // This should never happen, as constraint_controller doesn't
163     // ever finish.
164     ROS_INFO("Finished in state [%s]", state.toString().c_str());
165     ros::shutdown();
166 }
167
168 void onFeedback(const skill_transfer::MoveArmFeedbackConstPtr &feedback)
169 {
170     goal_distance_ = feedback->distance;
171 }
172
173 private:
174 void startPhase(int index)
175 {
176     ROS_ASSERT(index >= 0 && index < phase_count_);
177     ROS_ASSERT(state_ == State::Ready);
178
179     state_ = State::ObtainingMotionSpec;
180
181     // Obtain the motion spec
182     skill_transfer::GetMotionSpec srv;
183
184     srv.request.index = index;
185
186     if (!motion_spec_service_client_.call(srv))
187     {
188         throw std::runtime_error("Failed to call service get_task_spec");
189     }
190
191     spec_ = srv.response.spec;
192     stop_condition_ = srv.response.stop_condition;
193
194     state_ = State::Stopped;
195
196     phase_index_ = index;
197
198     goal_distance_ = std::numeric_limits<double>::infinity();
199     velocity_log_.clear();
200     command_log_.clear();
201
202     // Create and send goal
203     skill_transfer::MoveArmGoal goal;
204     goal.constraints = spec_;
205     // ROS_INFO("Spec:");
206     // ROS_INFO_STREAM(spec_);
207
208     ROS_INFO("Sending new goal.");
209
210     constraint_action_server_
211         .sendGoal(goal,
212                  boost::bind(&TaskExecutive::onFinish, this, _1, _2),
213                  actionlib::SimpleActionClient<skill_transfer::MoveArmAction>::

```

```

214         SimpleActiveCallback(),
215         boost::bind(&TaskExecutive::onFeedback, this, _1));
216     state_ = State::Running;
217 }
218
219 void finish()
220 {
221     constraint_action_server_.cancelGoal();
222
223     state_ = State::Finished;
224 }
225
226 void checkDesiredVelocityStop()
227 {
228     if (goal_distance_ > stop_condition_.activation_distance)
229     {
230         return;
231     }
232
233     if (!command_log_.allFilledAndBelowThreshold(stop_condition_.
234         desired_velocity_min))
235     {
236         return;
237     }
238
239     ROS_INFO("Desired_Velocity_Stop");
240
241     completePhase();
242 }
243
244 void checkMeasuredVelocityStop()
245 {
246     if (goal_distance_ > stop_condition_.activation_distance)
247     {
248         return;
249     }
250
251     if (!velocity_log_.allFilledAndBelowThreshold(stop_condition_.
252         measured_velocity_min))
253     {
254         return;
255     }
256
257     ROS_INFO("Measured_Velocity_Stop");
258
259     completePhase();
260 }
261
262 void checkContactStop()
263 {
264     if (!stop_condition_.contact)
265     {
266         return;
267     }
268
269     if (goal_distance_ > stop_condition_.activation_distance)

```

```

268     {
269         return;
270     }
271
272     ROS_INFO_STREAM("Contact_␣Stop");
273
274     completePhase();
275 }
276
277 void completePhase()
278 {
279     state_ = State::Stopped;
280
281     int next_phase_index = phase_index_ + 1;
282
283     state_ = State::Ready;
284
285     if (phase_count_ > next_phase_index)
286     {
287         ROS_INFO("Next");
288         startPhase(next_phase_index);
289     }
290     else
291     {
292         ROS_INFO("Finish");
293         finish();
294     }
295 }
296 };
297
298 int main(int argc, char **argv)
299 {
300     ros::init(argc, argv, "task_executive");
301     TaskExecutive executive;
302     executive.start();
303     ros::spin();
304
305     return 0;
306 }

```

268 action/MoveArm.action

```
1  # The goal
2  string constraints
3  ---
4  # The result
5  float64 distance
6  ---
7  # The feedback
8  float64 distance
```

269 config/simulator.rviz

```
1 Panels:
2   - Class: rviz/Displays
3     Help Height: 78
4     Name: Displays
5     Property Tree Widget:
6       Expanded:
7         - /Global Options1
8         - /Status1
9     Splitter Ratio: 0.5
10    Tree Height: 890
11   - Class: rviz/Selection
12     Name: Selection
13   - Class: rviz/Tool Properties
14     Expanded:
15       - /2D Pose Estimate1
16       - /2D Nav Goal1
17       - /Publish Point1
18     Name: Tool Properties
19     Splitter Ratio: 0.588679
20   - Class: rviz/Views
21     Expanded:
22       - /Current View1
23     Name: Views
24     Splitter Ratio: 0.5
25   - Class: rviz/Time
26     Experimental: false
27     Name: Time
28     SyncMode: 0
29     SyncSource: ""
30 Visualization Manager:
31   Class: ""
32   Displays:
33     - Alpha: 0.5
34       Cell Size: 1
35       Class: rviz/Grid
36       Color: 160; 160; 164
37       Enabled: true
38       Line Style:
39         Line Width: 0.03
40         Value: Lines
41       Name: Grid
42       Normal Cell Count: 0
43       Offset:
44         X: 0
45         Y: 0
46         Z: 0
47       Plane: XY
48       Plane Cell Count: 10
49       Reference Frame: <Fixed Frame>
50       Value: true
51     - Alpha: 1
52       Class: rviz/RobotModel
53       Collision Enabled: false
54       Enabled: true
55       Links:
```

```

56     All Links Enabled: true
57     Expand Joint Details: false
58     Expand Link Details: false
59     Expand Tree: false
60     Link Tree Style: Links in Alphabetic Order
61     base_bellow_link:
62         Alpha: 1
63         Show Axes: false
64         Show Trail: false
65         Value: true
66     base_footprint:
67         Alpha: 1
68         Show Axes: false
69         Show Trail: false
70         Value: true
71     base_laser_link:
72         Alpha: 1
73         Show Axes: false
74         Show Trail: false
75     base_link:
76         Alpha: 1
77         Show Axes: false
78         Show Trail: false
79         Value: true
80     bl_caster_l_wheel_link:
81         Alpha: 1
82         Show Axes: false
83         Show Trail: false
84         Value: true
85     bl_caster_r_wheel_link:
86         Alpha: 1
87         Show Axes: false
88         Show Trail: false
89         Value: true
90     bl_caster_rotation_link:
91         Alpha: 1
92         Show Axes: false
93         Show Trail: false
94         Value: true
95     br_caster_l_wheel_link:
96         Alpha: 1
97         Show Axes: false
98         Show Trail: false
99         Value: true
100    br_caster_r_wheel_link:
101        Alpha: 1
102        Show Axes: false
103        Show Trail: false
104        Value: true
105    br_caster_rotation_link:
106        Alpha: 1
107        Show Axes: false
108        Show Trail: false
109        Value: true
110    double_stereo_link:
111        Alpha: 1
112        Show Axes: false

```



```

113         Show Trail: false
114         Value: true
115     fl_caster_l_wheel_link:
116         Alpha: 1
117         Show Axes: false
118         Show Trail: false
119         Value: true
120     fl_caster_r_wheel_link:
121         Alpha: 1
122         Show Axes: false
123         Show Trail: false
124         Value: true
125     fl_caster_rotation_link:
126         Alpha: 1
127         Show Axes: false
128         Show Trail: false
129         Value: true
130     fr_caster_l_wheel_link:
131         Alpha: 1
132         Show Axes: false
133         Show Trail: false
134         Value: true
135     fr_caster_r_wheel_link:
136         Alpha: 1
137         Show Axes: false
138         Show Trail: false
139         Value: true
140     fr_caster_rotation_link:
141         Alpha: 1
142         Show Axes: false
143         Show Trail: false
144         Value: true
145     head_mount_kinect_ir_link:
146         Alpha: 1
147         Show Axes: false
148         Show Trail: false
149         Value: true
150     head_mount_kinect_ir_optical_frame:
151         Alpha: 1
152         Show Axes: false
153         Show Trail: false
154     head_mount_kinect_rgb_link:
155         Alpha: 1
156         Show Axes: false
157         Show Trail: false
158         Value: true
159     head_mount_kinect_rgb_optical_frame:
160         Alpha: 1
161         Show Axes: false
162         Show Trail: false
163     head_mount_link:
164         Alpha: 1
165         Show Axes: false
166         Show Trail: false
167         Value: true
168     head_mount_prosilica_link:
169         Alpha: 1

```

```

170     Show Axes: false
171     Show Trail: false
172     Value: true
173 head_mount_prosilica_optical_frame:
174     Alpha: 1
175     Show Axes: false
176     Show Trail: false
177 head_pan_link:
178     Alpha: 1
179     Show Axes: false
180     Show Trail: false
181     Value: true
182 head_plate_frame:
183     Alpha: 1
184     Show Axes: false
185     Show Trail: false
186     Value: true
187 head_tilt_link:
188     Alpha: 1
189     Show Axes: false
190     Show Trail: false
191     Value: true
192 high_def_frame:
193     Alpha: 1
194     Show Axes: false
195     Show Trail: false
196 high_def_optical_frame:
197     Alpha: 1
198     Show Axes: false
199     Show Trail: false
200 imu_link:
201     Alpha: 1
202     Show Axes: false
203     Show Trail: false
204 l_elbow_flex_link:
205     Alpha: 1
206     Show Axes: false
207     Show Trail: false
208     Value: true
209 l_force_torque_adapter_link:
210     Alpha: 1
211     Show Axes: false
212     Show Trail: false
213 l_force_torque_link:
214     Alpha: 1
215     Show Axes: false
216     Show Trail: false
217     Value: true
218 l_forearm_cam_frame:
219     Alpha: 1
220     Show Axes: false
221     Show Trail: false
222 l_forearm_cam_optical_frame:
223     Alpha: 1
224     Show Axes: false
225     Show Trail: false
226 l_forearm_link:

```

```

227     Alpha: 1
228     Show Axes: false
229     Show Trail: false
230     Value: true
231 l_forearm_roll_link:
232     Alpha: 1
233     Show Axes: false
234     Show Trail: false
235     Value: true
236 l_gripper_l_finger_link:
237     Alpha: 1
238     Show Axes: false
239     Show Trail: false
240     Value: true
241 l_gripper_l_finger_tip_frame:
242     Alpha: 1
243     Show Axes: false
244     Show Trail: false
245 l_gripper_l_finger_tip_link:
246     Alpha: 1
247     Show Axes: false
248     Show Trail: false
249     Value: true
250 l_gripper_led_frame:
251     Alpha: 1
252     Show Axes: false
253     Show Trail: false
254 l_gripper_motor_accelerometer_link:
255     Alpha: 1
256     Show Axes: false
257     Show Trail: false
258     Value: true
259 l_gripper_motor_screw_link:
260     Alpha: 1
261     Show Axes: false
262     Show Trail: false
263 l_gripper_motor_slider_link:
264     Alpha: 1
265     Show Axes: false
266     Show Trail: false
267 l_gripper_palm_link:
268     Alpha: 1
269     Show Axes: false
270     Show Trail: false
271     Value: true
272 l_gripper_r_finger_link:
273     Alpha: 1
274     Show Axes: false
275     Show Trail: false
276     Value: true
277 l_gripper_r_finger_tip_link:
278     Alpha: 1
279     Show Axes: false
280     Show Trail: false
281     Value: true
282 l_gripper_tool_frame:
283     Alpha: 1

```

```

284         Show Axes: false
285         Show Trail: false
286     l_shoulder_lift_link:
287         Alpha: 1
288         Show Axes: false
289         Show Trail: false
290         Value: true
291     l_shoulder_pan_link:
292         Alpha: 1
293         Show Axes: false
294         Show Trail: false
295         Value: true
296     l_torso_lift_side_plate_link:
297         Alpha: 1
298         Show Axes: false
299         Show Trail: false
300     l_upper_arm_link:
301         Alpha: 1
302         Show Axes: false
303         Show Trail: false
304         Value: true
305     l_upper_arm_roll_link:
306         Alpha: 1
307         Show Axes: false
308         Show Trail: false
309         Value: true
310     l_wrist_flex_link:
311         Alpha: 1
312         Show Axes: false
313         Show Trail: false
314         Value: true
315     l_wrist_roll_link:
316         Alpha: 1
317         Show Axes: false
318         Show Trail: false
319         Value: true
320     laser_tilt_link:
321         Alpha: 1
322         Show Axes: false
323         Show Trail: false
324     laser_tilt_mount_link:
325         Alpha: 1
326         Show Axes: false
327         Show Trail: false
328         Value: true
329     narrow_stereo_l_stereo_camera_frame:
330         Alpha: 1
331         Show Axes: false
332         Show Trail: false
333     narrow_stereo_l_stereo_camera_optical_frame:
334         Alpha: 1
335         Show Axes: false
336         Show Trail: false
337     narrow_stereo_link:
338         Alpha: 1
339         Show Axes: false
340         Show Trail: false

```

```

341     narrow_stereo_optical_frame:
342         Alpha: 1
343         Show Axes: false
344         Show Trail: false
345     narrow_stereo_r_stereo_camera_frame:
346         Alpha: 1
347         Show Axes: false
348         Show Trail: false
349     narrow_stereo_r_stereo_camera_optical_frame:
350         Alpha: 1
351         Show Axes: false
352         Show Trail: false
353     projector_wg6802418_child_frame:
354         Alpha: 1
355         Show Axes: false
356         Show Trail: false
357     projector_wg6802418_frame:
358         Alpha: 1
359         Show Axes: false
360         Show Trail: false
361     r_elbow_flex_link:
362         Alpha: 1
363         Show Axes: false
364         Show Trail: false
365         Value: true
366     r_forearm_cam_frame:
367         Alpha: 1
368         Show Axes: false
369         Show Trail: false
370     r_forearm_cam_optical_frame:
371         Alpha: 1
372         Show Axes: false
373         Show Trail: false
374     r_forearm_link:
375         Alpha: 1
376         Show Axes: false
377         Show Trail: false
378         Value: true
379     r_forearm_roll_link:
380         Alpha: 1
381         Show Axes: false
382         Show Trail: false
383         Value: true
384     r_gripper_l_finger_link:
385         Alpha: 1
386         Show Axes: false
387         Show Trail: false
388         Value: true
389     r_gripper_l_finger_tip_frame:
390         Alpha: 1
391         Show Axes: false
392         Show Trail: false
393     r_gripper_l_finger_tip_link:
394         Alpha: 1
395         Show Axes: false
396         Show Trail: false
397         Value: true

```

```

398     r_gripper_led_frame:
399         Alpha: 1
400         Show Axes: false
401         Show Trail: false
402     r_gripper_motor_accelerometer_link:
403         Alpha: 1
404         Show Axes: false
405         Show Trail: false
406         Value: true
407     r_gripper_motor_screw_link:
408         Alpha: 1
409         Show Axes: false
410         Show Trail: false
411     r_gripper_motor_slider_link:
412         Alpha: 1
413         Show Axes: false
414         Show Trail: false
415     r_gripper_palm_link:
416         Alpha: 1
417         Show Axes: false
418         Show Trail: false
419         Value: true
420     r_gripper_r_finger_link:
421         Alpha: 1
422         Show Axes: false
423         Show Trail: false
424         Value: true
425     r_gripper_r_finger_tip_link:
426         Alpha: 1
427         Show Axes: false
428         Show Trail: false
429         Value: true
430     r_gripper_tool_frame:
431         Alpha: 1
432         Show Axes: false
433         Show Trail: false
434     r_shoulders_lift_link:
435         Alpha: 1
436         Show Axes: false
437         Show Trail: false
438         Value: true
439     r_shoulders_pan_link:
440         Alpha: 1
441         Show Axes: false
442         Show Trail: false
443         Value: true
444     r_torso_lift_side_plate_link:
445         Alpha: 1
446         Show Axes: false
447         Show Trail: false
448     r_upper_arm_link:
449         Alpha: 1
450         Show Axes: false
451         Show Trail: false
452         Value: true
453     r_upper_arm_roll_link:
454         Alpha: 1

```

```

455         Show Axes: false
456         Show Trail: false
457         Value: true
458     r_wrist_flex_link:
459         Alpha: 1
460         Show Axes: false
461         Show Trail: false
462         Value: true
463     r_wrist_roll_link:
464         Alpha: 1
465         Show Axes: false
466         Show Trail: false
467         Value: true
468     sensor_mount_link:
469         Alpha: 1
470         Show Axes: false
471         Show Trail: false
472         Value: true
473     torso_lift_link:
474         Alpha: 1
475         Show Axes: false
476         Show Trail: false
477         Value: true
478     torso_lift_motor_screw_link:
479         Alpha: 1
480         Show Axes: false
481         Show Trail: false
482     wide_stereo_l_stereo_camera_frame:
483         Alpha: 1
484         Show Axes: false
485         Show Trail: false
486     wide_stereo_l_stereo_camera_optical_frame:
487         Alpha: 1
488         Show Axes: false
489         Show Trail: false
490     wide_stereo_link:
491         Alpha: 1
492         Show Axes: false
493         Show Trail: false
494     wide_stereo_optical_frame:
495         Alpha: 1
496         Show Axes: false
497         Show Trail: false
498     wide_stereo_r_stereo_camera_frame:
499         Alpha: 1
500         Show Axes: false
501         Show Trail: false
502     wide_stereo_r_stereo_camera_optical_frame:
503         Alpha: 1
504         Show Axes: false
505         Show Trail: false
506     Name: RobotModel
507     Robot Description: robot_description
508     TF Prefix: ""
509     Update Interval: 0
510     Value: true
511     Visual Enabled: true

```

```

512 Enabled: true
513 Global Options:
514   Background Color: 48; 48; 48
515   Fixed Frame: map
516   Frame Rate: 30
517 Name: root
518 Tools:
519   - Class: rviz/Interact
520     Hide Inactive Objects: true
521   - Class: rviz/MoveCamera
522   - Class: rviz/Select
523   - Class: rviz/FocusCamera
524   - Class: rviz/Measure
525   - Class: rviz/SetInitialPose
526     Topic: /initialpose
527   - Class: rviz/SetGoal
528     Topic: /move_base_simple/goal
529   - Class: rviz/PublishPoint
530     Single click: true
531     Topic: /clicked_point
532 Value: true
533 Views:
534   Current:
535     Class: rviz/Orbit
536     Distance: 2.45918
537     Enable Stereo Rendering:
538       Stereo Eye Separation: 0.06
539       Stereo Focal Distance: 1
540       Swap Stereo Eyes: false
541       Value: false
542     Focal Point:
543       X: 0.5601
544       Y: -0.301017
545       Z: 1.21782
546     Name: Current View
547     Near Clip Distance: 0.01
548     Pitch: 0.439797
549     Target Frame: <Fixed Frame>
550     Value: Orbit (rviz)
551     Yaw: 6.24358
552   Saved: ~
553 Window Geometry:
554   Displays:
555     collapsed: false
556   Height: 1176
557   Hide Left Dock: false
558   Hide Right Dock: true
559   QMainWindow State: 000000
    ff00000000fd000000040000000000000016b00000409fc0200000008fb0000001200530065006c0065006300740069006f006e
560 Selection:
561   collapsed: false
562 Time:
563   collapsed: false
564 Tool Properties:
565   collapsed: false
566 Views:

```



```
567     collapsed: true
568     Width: 1855
569     X: 65
570     Y: 24
```

270 Readme.md

```
1  ### IROS 2018
2  # Skill Transfer
3
4  ROS package that realises transfer of manipulation skills from known objects and
   situations to new, unseen objects and their setups.
5
6  ## Requirements
7
8  This package is **Developed and Tested on ROS Kinetic**.
9  At it's core, the system makes use of Giskard library for robot control: https://github.com/SemRoCo/giskard\_core
10
11  ## Architecture
12
13  The package consists of multiple ROS nodes that work collectively for achieving
   the desired effects. They communicate in roughly following manner:
14
15  ```
16  [FeatureDetector] <--> [KnowledgeManager] <--> [TaskExecutive] <--> [
   ConstraintController] <--> Actuators
17  ```
18
19  *KnowledgeManager* manages all specs needed for the task.
20
21  *TaskExecutive* is the main node that supervises the whole process and sends
   requests to all other nodes.
22
23  *FeatureDetector* finds desired object features (edge-point, ...)
24
25  *ConstraintController* uses Giskard internally, translates motion description
   files into desired joint velocities.
26
27  ### The Process
28
29  The whole process begins with *KnowledgeManager* reading task and setup YAML
   files. It decides what visual features are missing
30  from the description and asks *FeatureDetector* for them. Once the specs are
   ready *TaskExecutive* asks for them and the motion sequence begins.
31  *KnowledgeManager* provides individual motion specs to the *TaskExecutive*
   previously combining them with appropriate motion template.
32  Such prepared motion phase file is then sent to *ConstraintController* for
   execution. While that happens *TaskExecutive* observes
33  the state of the robot and decides when to finish one phase and begin the next
   one according to the task specification file.
34  When all motion phases are done the task is considered as finished.
35
36  ### Configuration files
37
38  There are configuration files that describe different levels of the system:
   motions, tasks, setups. All files are YAML.
39
40  *robot template* specifies the kinematic chain of a robot.
41
42  *motion phase* specifies motion in terms of constraints that should be satisfied.
43
```

```

44 *tasks* contains a sequence of motion phases and appropriate stop conditions as
    well as required visual features that should be resolved. Those elements
    together form a full task description.
45
46 *setups* specifies objects that take part in the task, calibrated grasp
    transformations and hand-coded visual features.
47
48 ### Supported tasks
49
50 1. Scraping butter off a tool into a container - not supported in this
    version
51 2. Scooping a substance (e.g. grains) from a container - not supported in
    this version
52 3. Cutting an object on a flat object/surface - not supported in this
    version
53 4. Tilting and grabbing an object, e.g. a book from a bookshelf
54
55 ## Installation
56 *Install ROS, then:
57 ```
58 mkdir -p ~/catkin_ws/src
59 cd ~/catkin_ws
60 catkin_init
61 cd src
62 wstool_init
63 wstool merge https://raw.githubusercontent.com/WeetaBixx/skill_transfer/master
    /rosinstall/catkin.rosinstall
64 wstool merge https://raw.githubusercontent.com/SemRoCo/giskard_core/master/
    rosinstall/catkin.rosinstall
65 wstool merge https://raw.githubusercontent.com/SemRoCo/giskard_pr2/master/
    rosinstall/catkin_indigo.rosinstall
66 wstool update
67 rosdep install --ignore-src --from-paths .
68 cd ..
69 catkin_build
70 source ~/catkin_ws/devel/setup.bash
71 ```
72 *Install Matlab executable from here:
73 https://github.com/pauloabelha/enzymes/blob/master/Bremen/edge_detector/
    for_redistribution/edge_detector_installer.install
74 ```
75 sudo edge_detector/edge_detector.install
76 ```
77 Add edge_detector application directory to your *PATH*, so you can run it with
    only following command:
78 ```
79 run_edge_detector.sh
80 ```
81
82 ## Running
83
84 Worlds with '_v' prefix are for free end effectors simulation only, '_p' for PR2
    simulation.
85
86 Experiment launch file can be run for freely flying end effectors simulation (
    argument 'robot:=free_ees') or simulated or real PR2 ('robot:=pr2').
87

```

```

88  ###_Running_with_Gazebo_simulator
89
90  1._Launch_the_Gazebo_world_and_keep_it_running
91  _ _ ''
92  _ _ roslaunch_skill_transfer_simulation.launch_world:=grabbing_book
93  _ _ ''
94
95  2._In_a_new_terminal,_launch_the_experiment
96  _ _ ''
97  _ _ roslaunch_skill_transfer_experiment.launch_task:=tiltgrabbing_robot:=free_ees_
    setup:=book_on_shelf
98  _ _ ''
99
100 ###_Running_with_Gazebo_and_iai_naive_kinematics_PR2_simulator
101
102 1._Launch_PR2_simulator,_keep_it_running
103 _ _ ''
104 _ _ roslaunch_skill_transfer_pr2.launch
105 _ _ ''
106 2._Launch_the_Gazebo_world,_keep_it_running
107 _ _ ''
108 _ _ roslaunch_skill_transfer_simulation.launch_world:=big_bowl_spatula_p
109 _ _ ''
110
111 3._In_a_new_terminal,_launch_the_experiment.
112 _ _ ''
113 _ _ roslaunch_skill_transfer_experiment.launch_task:=scraping_robot:=pr2_setup:=
    big_bowl_spatula
114 _ _ ''
115
116 ###_Running_with_real_robot
117
118 1._Prepare_the_robot.
119
120 2._Launch_the_experiment.
121 _ _ ''
122 _ _ roslaunch_skill_transfer_experiment.launch_task:=scraping_robot:=pr2_setup:=
    big_bowl_spatula
123 _ _ ''

```

271 *motion_templates/free_ees.yaml*

```

1 scope:
2   # definition of some nice short-cuts
3   - unit-x: {vector3: [1, 0, 0]}
4   - unit-y: {vector3: [0, 1, 0]}
5   - unit-z: {vector3: [0, 0, 1]}
6   - identity-rot: {axis-angle: [unit-x, 0]}
7   - zero-vec: {vector3: [0, 0, 0]}
8
9   # defintion of EE FK
10  - left_ee:
11    frame-mul:
12      - frame: [identity-rot, {vector3: [{input-var: 0}, 0, 0]}]
13      - frame: [identity-rot, {vector3: [0, {input-var: 1}, 0]}]
14      - frame: [identity-rot, {vector3: [0, 0, {input-var: 2}]}]
15      - frame: [{axis-angle: [unit-z, {input-var: 3}], zero-vec]
16      - frame: [{axis-angle: [unit-y, {input-var: 4}], zero-vec]
17      - frame: [{axis-angle: [unit-x, {input-var: 5}], zero-vec]
18
19  - right_ee:
20    frame-mul:
21      - frame: [identity-rot, {vector3: [{input-var: 6}, 0, 0]}]
22      - frame: [identity-rot, {vector3: [0, {input-var: 7}, 0]}]
23      - frame: [identity-rot, {vector3: [0, 0, {input-var: 8}]}]
24      - frame: [{axis-angle: [unit-z, {input-var: 9}], zero-vec]
25      - frame: [{axis-angle: [unit-y, {input-var: 10}], zero-vec]
26      - frame: [{axis-angle: [unit-x, {input-var: 11}], zero-vec]
27
28  - right_ee_2:
29    frame-mul:
30      - frame: [identity-rot, {vector3: [{input-var: 12}, 0, 0]}]
31      - frame: [identity-rot, {vector3: [0, {input-var: 13}, 0]}]
32      - frame: [identity-rot, {vector3: [0, 0, {input-var: 14}]}]
33      - frame: [{axis-angle: [unit-z, {input-var: 15}], zero-vec]
34      - frame: [{axis-angle: [unit-y, {input-var: 16}], zero-vec]
35      - frame: [{axis-angle: [unit-x, {input-var: 17}], zero-vec]
36
37  # control params
38  - rot_p_gain: 3.0
39  - rot_thresh: 0.1
40  - weight_rot_control: 1
41  - l_trans_vel_min: -0.3
42  - l_trans_vel_max: 0.3
43  - l_rot_vel_min: -0.5
44  - l_rot_vel_max: 0.5
45  - r_trans_vel_min: -0.3
46  - r_trans_vel_max: 0.3
47  - r_rot_vel_min: -0.5
48  - r_rot_vel_max: 0.5
49  - r_2_trans_vel_min: -0.3
50  - r_2_trans_vel_max: 0.3
51  - r_2_rot_vel_min: -0.5
52  - r_2_rot_vel_max: 0.5
53
54  controllable-constraints:
55    # left arm joints

```

```

56 - controllable-constraint: [l_trans_vel_min, l_trans_vel_max, controllable-
    weight, 0, l_gripper_pos_x]
57 - controllable-constraint: [l_trans_vel_min, l_trans_vel_max, controllable-
    weight, 1, l_gripper_pos_y]
58 - controllable-constraint: [l_trans_vel_min, l_trans_vel_max, controllable-
    weight, 2, l_gripper_pos_z]
59 - controllable-constraint: [l_rot_vel_min, l_rot_vel_max, controllable-weight,
    3, l_gripper_rot_x]
60 - controllable-constraint: [l_rot_vel_min, l_rot_vel_max, controllable-weight,
    4, l_gripper_rot_y]
61 - controllable-constraint: [l_rot_vel_min, l_rot_vel_max, controllable-weight,
    5, l_gripper_rot_z]
62 # right arm joints
63 - controllable-constraint: [r_trans_vel_min, r_trans_vel_max, controllable-
    weight, 6, r_gripper_pos_x]
64 - controllable-constraint: [r_trans_vel_min, r_trans_vel_max, controllable-
    weight, 7, r_gripper_pos_y]
65 - controllable-constraint: [r_trans_vel_min, r_trans_vel_max, controllable-
    weight, 8, r_gripper_pos_z]
66 - controllable-constraint: [r_rot_vel_min, r_rot_vel_max, controllable-weight,
    9, r_gripper_rot_x]
67 - controllable-constraint: [r_rot_vel_min, r_rot_vel_max, controllable-weight,
    10, r_gripper_rot_y]
68 - controllable-constraint: [r_rot_vel_min, r_rot_vel_max, controllable-weight,
    11, r_gripper_rot_z]
69
70 # second right arm joints
71 - controllable-constraint: [r_2_trans_vel_min, r_2_trans_vel_max, controllable
    -weight, 12, r_2_gripper_pos_x]
72 - controllable-constraint: [r_2_trans_vel_min, r_2_trans_vel_max, controllable
    -weight, 13, r_2_gripper_pos_y]
73 - controllable-constraint: [r_2_trans_vel_min, r_2_trans_vel_max, controllable
    -weight, 14, r_2_gripper_pos_z]
74 - controllable-constraint: [r_2_rot_vel_min, r_2_rot_vel_max, controllable-
    weight, 15, r_2_gripper_rot_x]
75 - controllable-constraint: [r_2_rot_vel_min, r_2_rot_vel_max, controllable-
    weight, 16, r_2_gripper_rot_y]
76 - controllable-constraint: [r_2_rot_vel_min, r_2_rot_vel_max, controllable-
    weight, 17, r_2_gripper_rot_z]
77
78 hard-constraints: [] # no hard constraints used in this motion
79
80 # Motion description should be appended below

```

272 motion_templates/pr2.yaml

```

1 scope:
2   # definition of some nice short-cuts
3   - unit-x: {vector3: [1, 0, 0]}
4   - unit-y: {vector3: [0, 1, 0]}
5   - unit-z: {vector3: [0, 0, 1]}
6
7   # definition of joint input variables
8   - torso_lift_joint: {input-var: 0}
9   - l_shoulder_pan_joint: {input-var: 1}
10  - l_shoulder_lift_joint: {input-var: 2}
11  - l_upper_arm_roll_joint: {input-var: 3}
12  - l_elbow_flex_joint: {input-var: 4}
13  - l_forearm_roll_joint: {input-var: 5}
14  - l_wrist_flex_joint: {input-var: 6}
15  - l_wrist_roll_joint: {input-var: 7}
16  - r_shoulder_pan_joint: {input-var: 8}
17  - r_shoulder_lift_joint: {input-var: 9}
18  - r_upper_arm_roll_joint: {input-var: 10}
19  - r_elbow_flex_joint: {input-var: 11}
20  - r_forearm_roll_joint: {input-var: 12}
21  - r_wrist_flex_joint: {input-var: 13}
22  - r_wrist_roll_joint: {input-var: 14}
23
24  # definition of joint transforms
25  - torso_lift:
26    frame: [{axis-angle: [unit-x, 0]}, {vector3: [-0.05, 0, {double-add:
27      [0.739675, torso_lift_joint]}]}]
28  - l_shoulder_pan:
29    frame: [{axis-angle: [unit-z, l_shoulder_pan_joint]}, {vector3: [0.0,
30      0.188, 0.0]}]
31  - l_shoulder_lift:
32    frame: [{axis-angle: [unit-y, l_shoulder_lift_joint]}, {vector3: [0.1, 0,
33      0]}]
34  - l_upper_arm_roll:
35    frame: [{axis-angle: [unit-x, l_upper_arm_roll_joint]}, {vector3: [0, 0,
36      0]}]
37  - l_elbow_flex:
38    frame: [{axis-angle: [unit-y, l_elbow_flex_joint]}, {vector3: [0.4, 0,
39      0]}]
40  - l_forearm_roll:
41    frame: [{axis-angle: [unit-x, l_forearm_roll_joint]}, {vector3: [0, 0,
42      0]}]
43  - l_wrist_flex:
44    frame: [{axis-angle: [unit-y, l_wrist_flex_joint]}, {vector3: [0.321, 0,
45      0]}]
46  - l_wrist_roll:
47    frame: [{axis-angle: [unit-x, l_wrist_roll_joint]}, {vector3: [0, 0, 0]}]
48  - l_gripper_offset:
49    frame: [{axis-angle: [unit-x, 0]}, {vector3: [0.2156, 0, 0]}]
50  - r_shoulder_pan:
51    frame: [{axis-angle: [unit-z, r_shoulder_pan_joint]}, {vector3: [0,
52      -0.188, 0]}]
53  - r_shoulder_lift:
54    frame: [{axis-angle: [unit-y, r_shoulder_lift_joint]}, {vector3: [0.1, 0,
55      0]}]

```

```

47 - r_upper_arm_roll:
48   frame: [{axis-angle: [unit-x, r_upper_arm_roll_joint]}, {vector3: [0, 0,
49     0]}]
50 - r_elbow_flex:
51   frame: [{axis-angle: [unit-y, r_elbow_flex_joint]}, {vector3: [0.4, 0,
52     0]}]
53 - r_forearm_roll:
54   frame: [{axis-angle: [unit-x, r_forearm_roll_joint]}, {vector3: [0, 0,
55     0]}]
56 - r_wrist_flex:
57   frame: [{axis-angle: [unit-y, r_wrist_flex_joint]}, {vector3: [0.321, 0,
58     0]}]
59 - r_wrist_roll:
60   frame: [{axis-angle: [unit-x, r_wrist_roll_joint]}, {vector3: [0, 0, 0]}]
61 - r_gripper_offset:
62   frame: [{axis-angle: [unit-x, 0]}, {vector3: [0.18, 0, 0]}]
63
64 # definition of elbow FK
65 - left_elbow:
66   frame-mul:
67     - torso_lift
68     - l_shoulder_pan
69     - l_shoulder_lift
70     - l_upper_arm_roll
71     - l_elbow_flex
72 - right_elbow:
73   frame-mul:
74     - torso_lift
75     - r_shoulder_pan
76     - r_shoulder_lift
77     - r_upper_arm_roll
78     - r_elbow_flex
79
80 # defintion of EE FK
81 - left_ee:
82   frame-mul:
83     - left_elbow
84     - l_forearm_roll
85     - l_wrist_flex
86     - l_wrist_roll
87     - l_gripper_offset
88 - right_ee:
89   frame-mul:
90     - right_elbow
91     - r_forearm_roll
92     - r_wrist_flex
93     - r_wrist_roll
94     - r_gripper_offset
95
96 # control params
97 - pos_p_gain: 3.0
98 - rot_p_gain: 3.0
99 - pos_thresh: 0.05
100 - rot_thresh: 0.1
101 - weight_arm_joints: 0.001
102 - weight_torso_joint: 0.01
103 - weight_pos_control: 1

```



```

100 - weight_rot_control: 1
101 - weight_elbow_control: 0
102 - l_neg_vel_limit_arm_joints: -0.6
103 - l_pos_vel_limit_arm_joints: 0.6
104 - r_neg_vel_limit_arm_joints: 0
105 - r_pos_vel_limit_arm_joints: 0
106 - neg_vel_limit_torso_joint: -0.02
107 - pos_vel_limit_torso_joint: 0.02
108
109 controllable-constraints:
110 # torso joint
111 - controllable-constraint: [neg_vel_limit_torso_joint,
112   pos_vel_limit_torso_joint, weight_torso_joint, 0, torso_lift_joint]
113 # left arm joints
114 - controllable-constraint: [l_neg_vel_limit_arm_joints,
115   l_pos_vel_limit_arm_joints, weight_arm_joints, 1, l_shoulder_pan_joint]
116 - controllable-constraint: [l_neg_vel_limit_arm_joints,
117   l_pos_vel_limit_arm_joints, weight_arm_joints, 2, l_shoulder_lift_joint]
118 - controllable-constraint: [l_neg_vel_limit_arm_joints,
119   l_pos_vel_limit_arm_joints, weight_arm_joints, 3, l_upper_arm_roll_joint]
120 - controllable-constraint: [l_neg_vel_limit_arm_joints,
121   l_pos_vel_limit_arm_joints, weight_arm_joints, 4, l_elbow_flex_joint]
122 - controllable-constraint: [l_neg_vel_limit_arm_joints,
123   l_pos_vel_limit_arm_joints, weight_arm_joints, 5, l_forearm_roll_joint]
124 - controllable-constraint: [l_neg_vel_limit_arm_joints,
125   l_pos_vel_limit_arm_joints, weight_arm_joints, 6, l_wrist_flex_joint]
126 - controllable-constraint: [l_neg_vel_limit_arm_joints,
127   l_pos_vel_limit_arm_joints, weight_arm_joints, 7, l_wrist_roll_joint]
128 # right arm joints
129 - controllable-constraint: [r_neg_vel_limit_arm_joints,
130   r_pos_vel_limit_arm_joints, weight_arm_joints, 8, r_shoulder_pan_joint]
131 - controllable-constraint: [r_neg_vel_limit_arm_joints,
132   r_pos_vel_limit_arm_joints, weight_arm_joints, 9, r_shoulder_lift_joint]
133 - controllable-constraint: [r_neg_vel_limit_arm_joints,
134   r_pos_vel_limit_arm_joints, weight_arm_joints, 10, r_upper_arm_roll_joint]
135 - controllable-constraint: [r_neg_vel_limit_arm_joints,
136   r_pos_vel_limit_arm_joints, weight_arm_joints, 11, r_elbow_flex_joint]
137 - controllable-constraint: [r_neg_vel_limit_arm_joints,
138   r_pos_vel_limit_arm_joints, weight_arm_joints, 12, r_forearm_roll_joint]
139 - controllable-constraint: [r_neg_vel_limit_arm_joints,
140   r_pos_vel_limit_arm_joints, weight_arm_joints, 13, r_wrist_flex_joint]
141 - controllable-constraint: [r_neg_vel_limit_arm_joints,
142   r_pos_vel_limit_arm_joints, weight_arm_joints, 14, r_wrist_roll_joint]
143
144 hard-constraints:
145 - hard-constraint:
146   - {double-sub: [0.0115, torso_lift_joint]}
147   - {double-sub: [0.325, torso_lift_joint]}
148   - torso_lift_joint
149 - hard-constraint:
150   - {double-sub: [-0.5646, l_shoulder_pan_joint]}
151   - {double-sub: [2.1353, l_shoulder_pan_joint]}
152   - l_shoulder_pan_joint
153 - hard-constraint:
154   - {double-sub: [-0.3536, l_shoulder_lift_joint]}
155   - {double-sub: [1.2963, l_shoulder_lift_joint]}
156   - l_shoulder_lift_joint

```

```

142 - hard-constraint:
143   - {double-sub: [-0.65, l_upper_arm_roll_joint]}
144   - {double-sub: [3.75, l_upper_arm_roll_joint]}
145   - l_upper_arm_roll_joint
146 - hard-constraint:
147   - {double-sub: [-2.1213, l_elbow_flex_joint]}
148   - {double-sub: [-0.15, l_elbow_flex_joint]}
149   - l_elbow_flex_joint
150 - hard-constraint:
151   - {double-sub: [-2.0, l_wrist_flex_joint]}
152   - {double-sub: [-0.1, l_wrist_flex_joint]}
153   - l_wrist_flex_joint
154 - hard-constraint:
155   - {double-sub: [-2.1353, r_shoulder_pan_joint]}
156   - {double-sub: [0.5646, r_shoulder_pan_joint]}
157   - r_shoulder_pan_joint
158 - hard-constraint:
159   - {double-sub: [-0.3536, r_shoulder_lift_joint]}
160   - {double-sub: [1.2963, r_shoulder_lift_joint]}
161   - r_shoulder_lift_joint
162 - hard-constraint:
163   - {double-sub: [-3.75, r_upper_arm_roll_joint]}
164   - {double-sub: [0.65, r_upper_arm_roll_joint]}
165   - r_upper_arm_roll_joint
166 - hard-constraint:
167   - {double-sub: [-2.1213, r_elbow_flex_joint]}
168   - {double-sub: [-0.15, r_elbow_flex_joint]}
169   - r_elbow_flex_joint
170 - hard-constraint:
171   - {double-sub: [-2.0, r_wrist_flex_joint]}
172   - {double-sub: [-0.1, r_wrist_flex_joint]}
173   - r_wrist_flex_joint
174
175 # Motion description should be appended below

```