Robotique

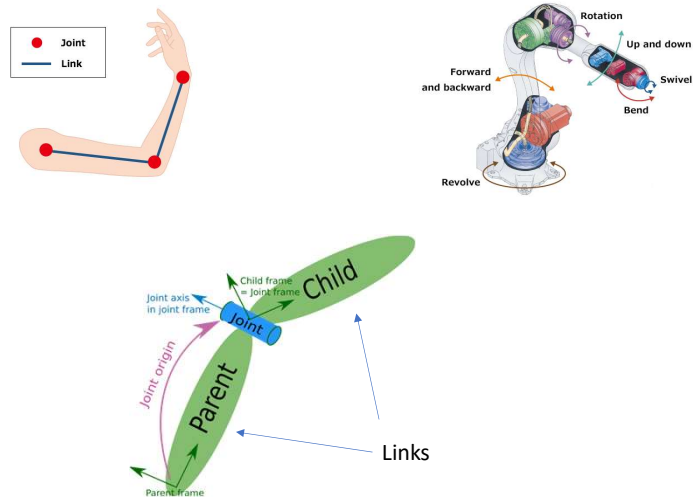**EL 3007**

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Présentation ESIEE Paris
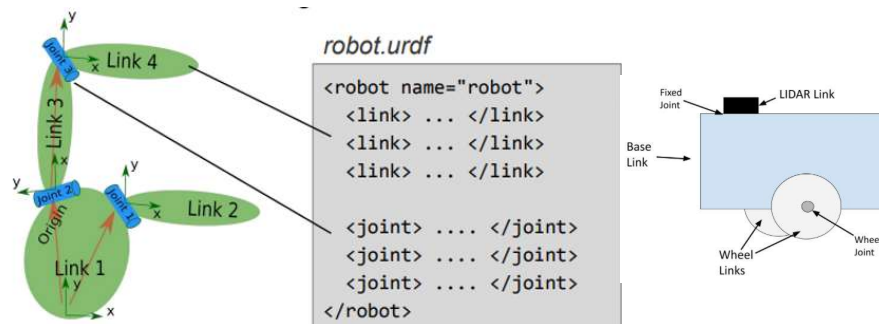
1

Description de Robots - URDF

2

Link et joint

3

URDF

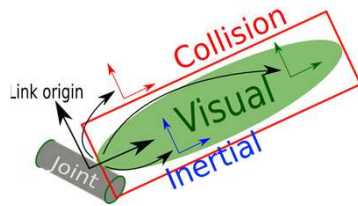- La description du robot est structurée en pièces (links) reliées par des liaisons (joints)


```
robot.urdf

<robot name="robot">
  <link> ... </link>
  <link> ... </link>
  <link> ... </link>

  <joint> .... </joint>
  <joint> .... </joint>
  <joint> .... </joint>
</robot>
```

4

URDF - link

Description d'un link


```
<link name="base_link">
  <visual>
   <geometry>

   </geometry>
  </visual>
</link>
```

5
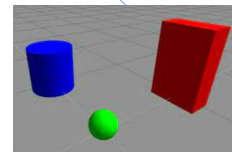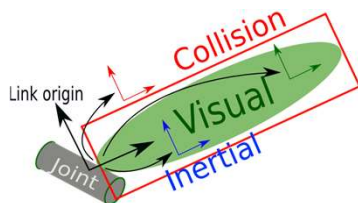
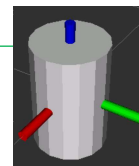# URDF - link

Géométrie des objets


```
<link name="base_link">
  <visual>
   <geometry>
       <cylinder length="0.6" radius="0.2"/>
   </geometry>
  </visual>
</link>
```

6

URDF - link

Géométrie des objets


```
<link name="sphere_link">
  <visual>
    <geometry>
      <sphere radius="0.16"/>
    </geometry>
  </visual>
</link>
```

7

URDF - link

Géométrie des objets


```
<link name="box_link">
  <visual>
    <geometry>
      <box size="0.6 0.2 0.1"/>
    </geometry>
  </visual>
</link>
```
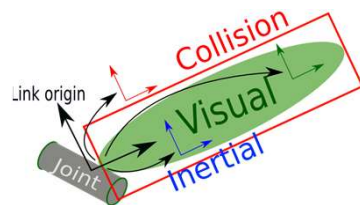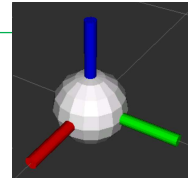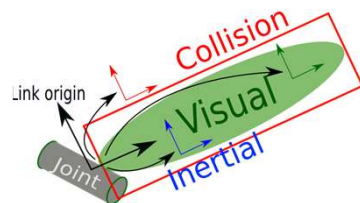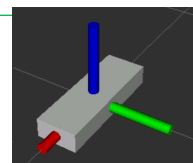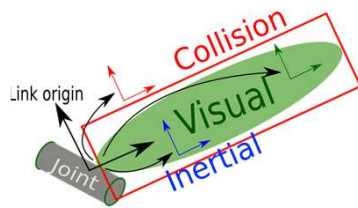
8

URDF - link

Rotation des objets


```
<link name="box_link">
  <visual>
   <geometry>
       <box size="0.6 0.2 0.1"/>
   </geometry>
      <origin rpy="0 1.57075 0" xyz="0 0 0"/>
  </visual>
  </link>
```


rotation

9

URDF - link

Translation des objets


```
<link name="box_link">
  <visual>
   <geometry>
       <box size="0.6 0.2 0.1"/>
   </geometry>
      <origin rpy="0 1.57075 0" xyz="0 0 -0.3"/>
  </visual>
  </link>
```
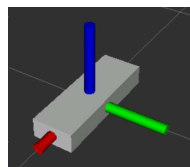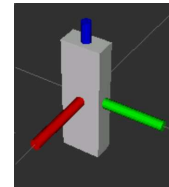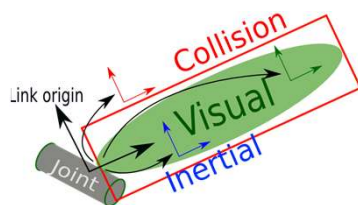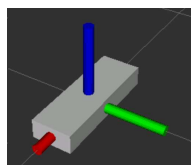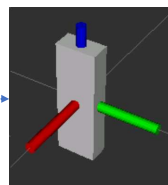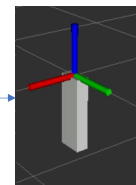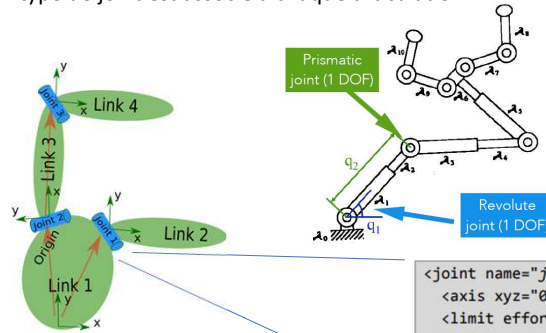

rotation   translation

10

URDF-joint

- Description d'un joint
- Un type de joint est associé à chaque articulation


```
<joint name="joint_name" type="revolute">
    <axis xyz="0 0 1"/>
    <limit effort="1000.0" upper="0.548" ... />
    <origin rpy="0 0 0" xyz="0.2 0.01 0"/>
    <parent link="parent_Link_name"/>
    <child link="child_link_name"/>
</joint>
```

11

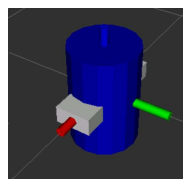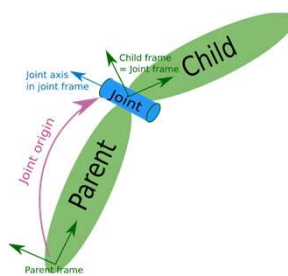# URDF-joint

```
<link name="base_link">
  <visual>
    <geometry>
        <cylinder length="0.6" radius="0.2"/>
    </geometry>
  </visual>
</link>

<link name="box_link">
  <visual>
    <geometry>
        <box size="0.6 0.2 0.1"/>
    </geometry>
  </visual>
</link>

<joint name="base_to_box_joint" type="fixed">
    <parent link="base_link"/>
    <child link="box_link"/>
    <origin  xyz="0 0 0"/>
</joint>
```

12

6

URDF-joint

Robot v1

13

URDF-joint

Description de points jonction

http://wiki.ros.org/urdf/XML/joint


```
<link name="base_link">
  <visual>
    <geometry>
        <cylinder length="0.6" radius="0.2"/>
    </geometry>
  </visual>
</link>

<link name="box_link">
  <visual>
    <geometry>
        <box size="0.6 0.2 0.1"/>
    </geometry>
    <origin rpy="0 1.57075 0" xyz="0 0 -0.3"/>
  </visual>
</link>
<joint name="base_to_box_joint" type="fixed">
    <parent link="base_link"/>
    <child link="box_link"/>
    <origin xyz="0.2 0 0"/>
</joint>
```
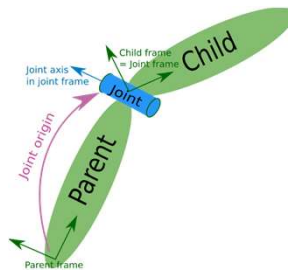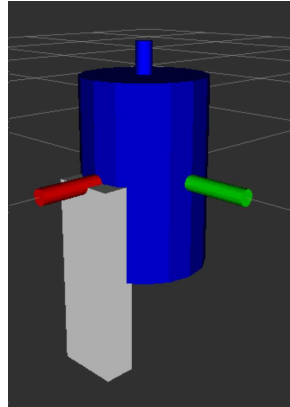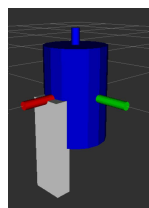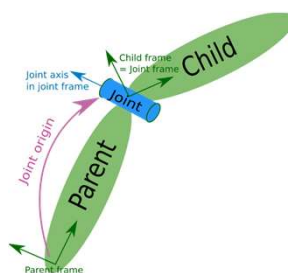
14
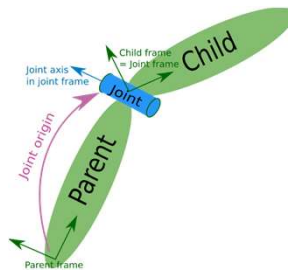
URDF-joint

Robot v2 : jambe mobile
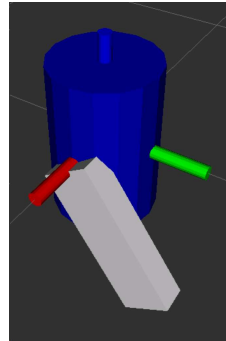

15

URDF-joint

http://wiki.ros.org/urdf/XML/joint

- Un type de liaison est associé à chaque articulation

continuous joint
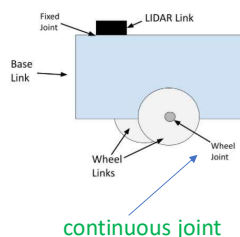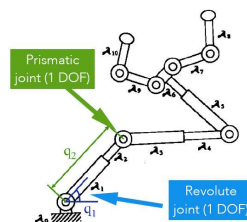
•revolute : une articulation qui tourne le long de l'axe et a une plage limitée spécifiée par les limites supérieure et inférieure.

•continuous - une articulation à charnière continue qui tourne autour de l'axe et n'a pas de limites supérieure et inférieure.

•prismatic - un joint coulissant qui glisse le long de l'axe et a une plage limitée spécifiée par les limites supérieure et inférieure.

•fixed - Ce n'est pas vraiment une articulation car elle ne peut pas bouger. Tous les degrés de liberté sont verrouillés. Ce type d'articulation ne nécessite pas l'axe, l'étalonnage, la dynamique, les limites ou le safety_controller.

•floating - Cette articulation permet le mouvement pour les 6 degrés de liberté.

•planar - Cette articulation permet un mouvement dans un plan perpendiculaire à l'axe.

16

URDF-joint

Point de jonction mobile


```
<link name="base_link">
  <visual>
    <geometry>
      <cylinder length="0.6" radius="0.2"/>
    </geometry>
  </visual>
</link>

<link name="box_link">
  <visual>
    <geometry>
      <box size="0.6 0.2 0.1"/>
    </geometry>
    <origin rpy="0 1.57075 0" xyz="0 0 -0.3"/>
  </visual>
</link>
<joint name="base_to_box_joint" type="continuous">
  <parent link="base_link"/>
  <child link="box_link"/>
  <origin xyz="0.2 0 0"/>
  <axis xyz="1 0 0"/>
</joint>
```
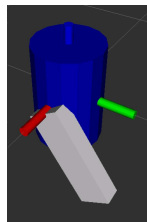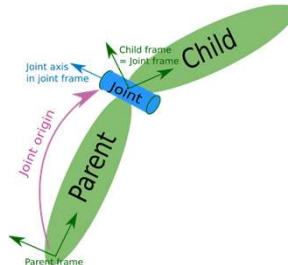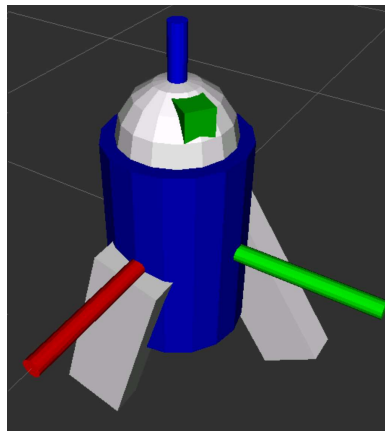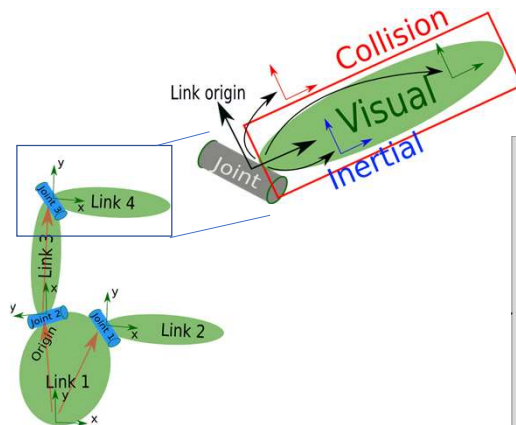
17

URDF-joint

Robot v3 : pied, tête, yeux ;-)

18

# URDF – link collision inertial

Description d'un link


```
<link name="link_name">
  <visual>
    <geometry>
      <mesh filename="mesh.dae"/>
    </geometry>
  </visual>
  <collision>
    <geometry>
      <cylinder length="0.6" radius="0.2"/>
    </geometry>
  </collision>
  <inertial>
    <mass value="10"/>
    <inertia ixx="0.4" ixy="0.0" .../>
  </inertial>
</link>
```
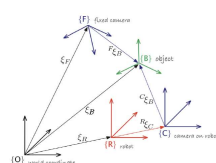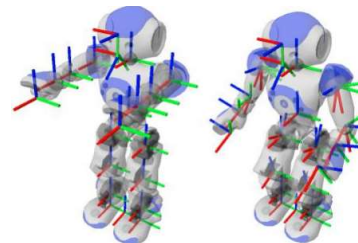
19

URDF-Système de référentiel

- Chaque pièce du robot possède un repère

lié à l'articulation (frames)

- Repère principal : base_link, utilisé pour la

localisation et la navigation.

• Les capteurs et les pièces sont en

mouvements, leurs données doivent être

transformées dans un même repère

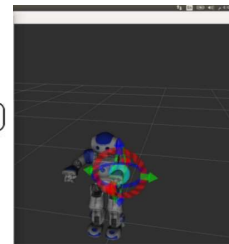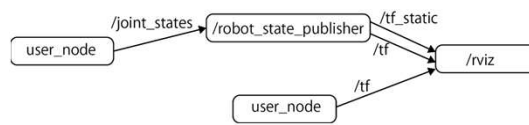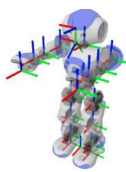• Matrice de changement de repères ➔ Calcul matriciel simplifié
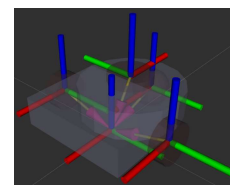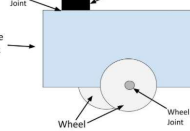
20

Package ROS TF2

ROS utilise la bibliothèque TF2 (transform version 2): API de calcul géométrique et matriciel
Calcul les transformations entre les repères, à partir d'un fichier de description des articulations au format urdf
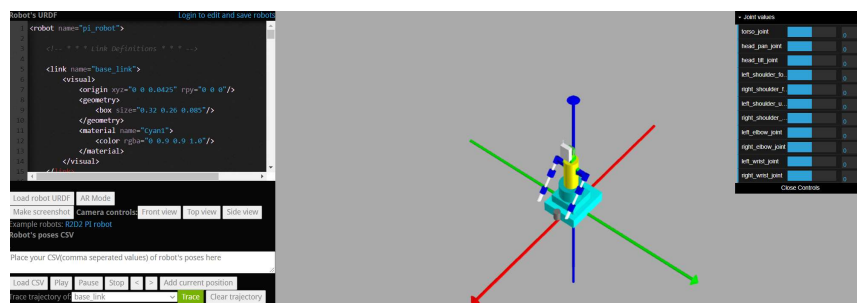• Partage réseau des données entre les noeuds ROS

21

URDF-outil

http://mymodelrobot.appspot.com/5629499534213120

22