4) Basic SF actions

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The next tutorial is 5) Writing a basic SF script

The ReFlex fingers (both Takktile and SF) can be position controlled, velocity controlled, or force controlled. Make sure the hand has been calibrated before using any of these commands.

Position control

As seen in the previous tutorial, the fingers can be sent a set of position commands.

```
roslaunch reflex reflex_sf.launch
rostopic pub /reflex_sf/command_position reflex_msgs/PoseCommand "f1: 1.0
f2: 1.0
f3: 1.0
preshape: 0.0"
```

NOTE: The fingers will stop when overloaded in this state, as mentioned in the Safety Overloads section of the *previous tutorial*.

Velocity control

Velocity control can be used to make the motors open or close at a given speed. This could be used to slowly creep to a grip, or it could just be a simple way of quickly clamping down on an object within the hand. The fingers will close when commanded with positive velocity, open when commanded with negative. The motors will stop when they reach their travel limits, whether that is closed or open.

```
# Assuming code is still running
rostopic pub /reflex_sf/command_velocity reflex_msgs/VelocityCommand "f1: 5.0
f2: 1.0
f3: 0.25
preshape: 0.0"
rostopic pub /reflex_sf/command_velocity reflex_msgs/VelocityCommand "f1: -0.25
f2: -1.0
f3: -5.0
preshape: 0.0"
```

NOTE: The fingers will stop when overloaded in this state, as mentioned in the Safety Overloads section of the *previous tutorial*.

Combined position and velocity control

Combining position and velocity control is simple, the motors can be commanded to reach a given position with a given velocity. This allows you flexibility in the tasks you attempt with the hand.

```
# Assuming code is still running
rostopic pub /reflex_sf/command reflex_msgs/Command "pose:
  f1: 3.0
  f2: 2.0
  f3: 1.0
  preshape: 0.0
velocity:
  f1: 0.5
  f2: 1.0
  f3: 5.0
  preshape: 0.0"
rostopic pub /reflex_sf/command reflex_msgs/Command "pose:
  f1: 0.0
  f2: 2.0
  f3: 1.0
  preshape: 0.0
velocity:
```

```
f1: 0.5
f2: 5.0
f3: 1.0
preshape: 0.0"
```

NOTE: The easiest way to enter this type of command in terminal is to type it up through Command, regularly tab-completing the longer sections, then hit tab to auto-fill the portion with f1, f2, etc. It is a pain to type that in by hand. You can also add a -1 right after pub to make the command send once and end, but then it won't tab-complete. I usually make the whole command and then go back to add -1. Such is the rostopic terminal tool.

Rough force control

How to send a command

An interesting feature in the Takktile and SF code is force control, the motors can be commanded to a force and a control loop in the code tries to follow that command. To get out of this mode, just send another type of command, like those shown above.

```
# Assuming code is still running
rostopic pub /reflex_sf/command_motor_force reflex_msgs/ForceCommand "f1: 200.0
f2: 200.0
f3: 200.0
preshape: 0.0"
```

NOTE: The finger will loosen when overloaded, leading to oscillations if the commanded force is too close to the overload threshold. More details about the overload threshold can be found in the Safety Overloads section of the previous tutorial

NOTE: The control code attempts to keep the force on the actuating motor constant, which means that actual applied force will vary depending on where along the finger the force is applied. This is because the finger acts as a variable lever arm.

How to monitor the current motor loads

ROS has a simple tool for plotting data being published on topics, rqt_plot. If you want to see the current motor loads, run the plot tool:

```
rqt_plot
```

You'll see a place to enter a topic to plot. To live plot the motor loads, enter the following topics:

```
/reflex_sf/hand_state/motor[0]/load
/reflex_sf/hand_state/motor[1]/load
/reflex_sf/hand_state/motor[2]/load
/reflex_sf/hand_state/motor[3]/load
```


Keep going on to 5) Writing a basic SF script

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