

Workspace Visualization for Robotic Arms

24783 Project

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Project objective - base version

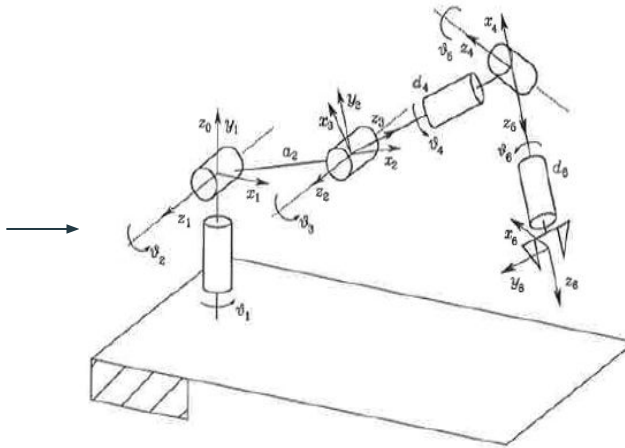
The UR5 URDF file (kinematics and inertial properties only).

```
<?xml version="1.0" ?>
<robot name="ur5">

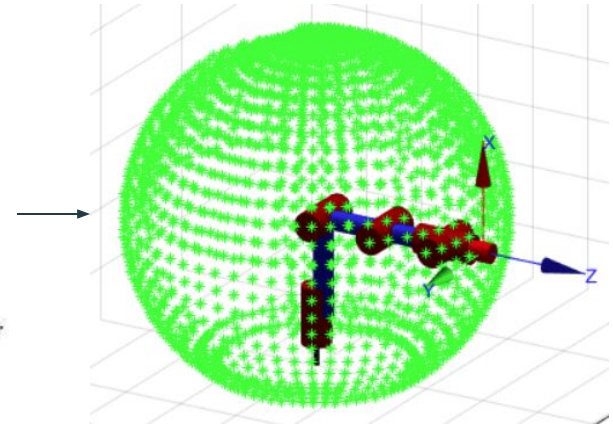
<!-- ***** KINEMATIC PROPERTIES (JOINTS) ***** -->
<joint name="world_joint" type="fixed">
  <parent link="world"/>
  <child link="base_link"/>
  <origin rpy="0.0 0.0 0.0" xyz="0.0 0.0 0.0"/>
</joint>
<joint name="joint1" type="continuous">
  <parent link="base_link"/>
  <child link="link1"/>
  <origin rpy="0.0 0.0 0.0" xyz="0.0 0.0 0.089159"/>
  <axis xyz="0 0 1"/>
</joint>
<joint name="joint2" type="continuous">
  <parent link="link1"/>
  <child link="link2"/>
  <origin rpy="0.0 1.570796325 0.0" xyz="0.0 0.13585 0.0"/>
  <axis xyz="0 1 0"/>
</joint>
<joint name="joint3" type="continuous">
  <parent link="link2"/>
  <child link="link3"/>
  <origin rpy="0.0 0.0 0.0" xyz="0.0 -0.1197 0.425"/>
  <axis xyz="0 1 0"/>
</joint>
<joint name="joint4" type="continuous">
  <parent link="link3"/>
  <child link="link4"/>
  <origin rpy="0.0 1.570796325 0.0" xyz="0.0 0.0 0.39225"/>
  <axis xyz="0 1 0"/>
</joint>
<joint name="joint5" type="continuous">
  <parent link="link4"/>
  <child link="link5"/>
  <origin rpy="0.0 0.0 0.0" xyz="0.0 0.093 0.0"/>
  <axis xyz="0 1 0"/>
</joint>
<joint name="joint6" type="continuous">
  <parent link="link5"/>
  <child link="link6"/>
  <origin rpy="0.0 0.0 0.0" xyz="0.0 0.0 0.09465"/>
  <axis xyz="0 1 0"/>
</joint>
<joint name="ee_joint" type="fixed">
  <origin rpy="-1.570796325 0 0" xyz="0 0.0823 0"/>
  <parent link="link6"/>
  <child link="ee_link"/>
</joint>

</robot>
```

Read URDF file



Forward Kinematics
with parallel computing



Workspace visualization
(Using RVIZ)

Why it is important

- A handy tool to compute and visualize all reachable locations per setup of the robotic arm (i.e. from a urdf file)
- Help better understand the modelling and kinematics of robotics arms
- Practice C++ programming concepts such as OOP, multi-threading and data structures for optimization

Goals beyond MVP

3D model of workspace (w/o using built-in visualization tool from ROS)

Inverse Kinematics Map

- Receive necessary joint angles and/or joint length to achieve a specific end effector configuration

User Interface

- Allow user to input desired end effector location for inverse kinematics
- Allow user to modify existing robot config and generate new workspace

