1.About Unified Robot Description Format

The first line is required for xml, which describes the version information of xml.

The second line describes the current robot name; all the current robot information is contained in the label.

URDF mainly includes two parts: Links and Joints, with the suffix .urdf.

- Links: Links, coordinate systems and geometric relations.
- Joints: the connection relationship between joints and Links.

2.Links

2.1 Introduction

In the URDF descriptive language, link is used to describe physical characteristics.

Describe the visual display, the <visual> tag.

Describe collision properties, <collision> tag.

Describe physical inertia, <inertial> tag, not commonly used.

Links can also describe link size (size) \ color (shape) \ inertial matrix (inertial matrix) \ collision properties (collision properties), etc., each link will become a coordinate system.

2.2 Code

```
<link name="link1">
    <visual>
        <origin xyz="0 0 0" rpy="0 0 0" />
        <geometry>
            <mesh filename="package://dofbot_moveit/meshes/link1.STL" />
        </geometry>
        <material name="">
            <color rgba="0 0.627450980392157 0.235294117647059 1" />
        </material>
    </visual>
    <collision>
        <origin xyz="0 0 0" rpy="0 0 0" />
        <geometry>
            <mesh filename="package://dofbot_moveit/meshes/link1.STL" />
        </geometry>
    </collision>
</link>
```

The name attribute in the <link> tag is a required item, describing the name of the current link.

2.3 Label introduction

The <origin> tag describes the pose information; the xyz attribute describes the coordinate position in the large environment, and the rpy attribute describes its own posture.

The <geometry> tag describes the shape; the main function of the mesh attribute is to load the texture file, and the file address of the filename attribute texture path.
The <geometry> tag also includes other tag descriptions:
box box<box size="1 2 3" />Describe the length, width and height of the box through the size attribute.
Cylinder cylindrical <cylinder length="1.6" radius="0.5"/>, the height of the cylinder is described by the length attribute, and the radius of the cylinder is described by the radius attribute.
sphere spherical <sphere radius="1" />, the radius of the sphere is described by the radius attribute.
The <material> tag describes the material; the name attribute is required, can be empty, and can be repeated. The red, green, blue, and transparency are described by the rgba attribute in the tag, separated by a space. The color range is [0-1].

3.Joints

3.1 Introduction

Describe the relationship between two joints. Motion position and speed limits. Kinematics and dynamics properties.
Joint type:
fixed: fixed joints. No movement is allowed and it serves as a connection.
continuous: rotating joints. Can continue to rotate, there is no restriction on the angle of rotation.
revolute: revolving joints. Similar to continuous, there is a limit to the rotation angle.
prismatic: sliding joints. Moving along a certain axis, there are position restrictions.
floating: floating joints. With six degrees of freedom, 3T3R.
planar: planar joints. Allow translation or rotation above the plane orthogonal.

3.2 Code

```
<joint name="joint1" type="revolute">
    <origin xyz="0 0 0.06605" rpy="-0.010805 0 0" />
    <parent link="base_link" />
    <child link="link1" />
    <axis xyz="0 0 1" />
    <limit effort="30" velocity="1.0" lower="-1.5708" upper="1.5708"/>
</joint>
```

The name attribute in the <joint> tag is a required item, which describes the name of the joint and is unique.
Fill in the six joint types corresponding to the type attribute in the <joint> tag.

3.3 Label introduction

The <parent> and <child> child tags represent two <link>s to be connected, which correspond to the name attribute in <link>; here, <parent> is used as a reference, and <child> is carried out around <parent> Spin.

The <origin> child tag refers to the relative position of the rotation joint in the coordinate system where the parent is located.
The <axis> child tag indicates which axis the <link> corresponding to <child> rotates around.
The <limit> child tag mainly limits the <child>. The lower attribute and upper attribute limit the range of rotation in radians, the effort attribute limits the range of force during the rotation. (positive and negative value, the unit is cattle or N), the velocity attribute limits the speed of rotation, the unit is meters /Sec or m/s.

4. Introduction of launch file

The launch file is an xml file used to describe the startup of a node, and multiple nodes can be started at the same time.
Code:

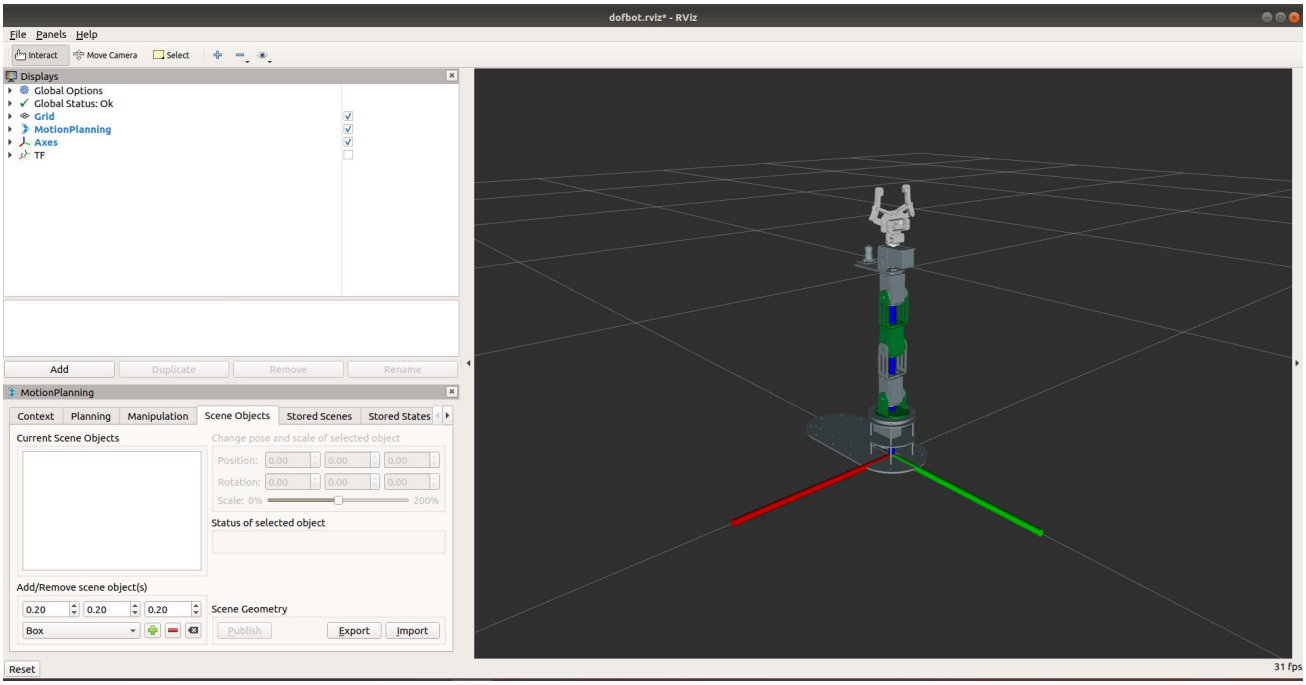
```
<launch>
    <arg name="model" default="dofbot.urdf"/>
    <arg name="gui" default="false"/>
    <param name="robot_description" command="$(find xacro)/xacro --inorder $(find
dofbot_moveit)/urdf/$(arg model)"/>
    <param name="use_gui" value="$(arg gui)"/>
    <node name="joint_state_publisher_gui" pkg="joint_state_publisher_gui"
type="joint_state_publisher_gui"/>
    <node name="robot_state_publisher" pkg="robot_state_publisher"
type="robot_state_publisher"/>
    <node name="rviz" pkg="rviz" type="rviz" args="-d $(find
dofbot_moveit)/rviz/arm_urdf.rviz" required="true"/>
</launch>
```

The name of the package to start with the pkg attribute.
The type attribute executable file name.
The name attribute of the node name after the executable file is started.
The <param> subtag is the result output after xacro executes dofbot.urdf as a value and assigned to robot_description.
The <arg> subtag, the name attribute is the parameter name, and the default attribute is the default parameter.

5. URDF visualization

Open the command type break and execute the following commands in sequence

```
cd ~/dofbot_ws/    # Enter the workspace
catkin_make      # Compile
source devel/setup.bash # Update system environment
roslaunch dofbot_moveit dofbot_moveit.launch # Start the ROS node
```



The red axis is the X axis; the green axis is the Y axis; the blue axis is the Z axis;
The coordinate system formed by the three axes is the base coordinate system.