8 Robot URDF model

According to different models, you only need to set the purchased model in [.bashrc], X1(ordinary four-wheel drive) X3(Mike wheel) X3plus(Mike wheel mechanical arm) R2(Ackerman differential) and so on. Section takes X3 as an example:

```
sudo vim .bashrc
```

Find the [ROBOT_TYPE] parameter and modify the corresponding model

```
export ROBOT_TYPE=X3    # ROBOT_TYPE: X1 X3 X3plus R2 X7
```

8.1 URDF overview

Function package reference path: ~/yahboomcar_ws/src/yahboomcar_description

8.1.1 Introduction

URDF, the full name of Unified Robot Description Format, translated into Chinese as Unified Robot Description Format, is a robot model file described in xml format, similar to DH parameters.

```
<?xml  version="1.0" encoding="utf-8"?>
< robot  name = "yahboomcar" >


</ robot >
```

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

The second line describes the current robot name; all information about the current robot is contained in the [robot] tag.

8.1.2 Components

1. link, connecting rod, can be imagined as a human arm.
2. joint, joint, can be imagined as a human elbow.

The relationship between link and joint: two links are connected by joints.

8.1.3 links

1 Introduction

In the URDF descriptive language, links are used to describe physical properties.

- describe the visual display, `<visual>` Label.
- describe collision properties, `<collision>` Label.
- describe physical inertia, `<inertial>` Labels are not commonly used.

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

2. sample code: ~/yahboomcar_ws/src/yahboomcar_description/urdf/yahboomcar_X3.urdf

```
< link  name = "front_left_wheel" >
    < inertial >
        < origin  xyz = "2.3728E-06 -9.4228E-07 0.00064068"  rpy = "0 0 0"
/>
        < mass  value = "0.051543" />
        < inertia  1.4597E = -05"  ixy = "-4.7945E-10"  ixz = "-2.4786E-10"
                iyy = "1.4598E-05"  iyz = "1.7972E-09"  izz = "2.4267E-05"
/>
    </ inertial >
    < visual >
        < origin  xyz = "0 0 0"  rpy = "0 0 0" />
        < geometry >
            < mesh  filename =
"package://yahboomcar_description/meshes/mecanum/front_left_wheel.STL" />
        </ geometry >
        < material  name = "" >
            < color  rgba = "0.7 0.7 0.7 1" />
        </ material >
    </ visual >
    < collision >
        < origin  xyz = "0 0 0"  rpy = "0 0 0" />
        < geometry >
            < mesh  filename =
"package://yahboomcar_description/meshes/mecanum/front_left_wheel.STL" />
        </ geometry >
    </ collision >
</ link >
```

3. label introduction

- origin

  Describes the pose information; `xyz` The attribute describes the coordinate position in the environment, `rpy` Attributes describe their own posture.

- mess

  Describes the quality of the link.

- inertia

  The inertial reference frame, due to the symmetry of the rotational inertia matrix, only needs 6 upper triangular elements ixx, ixy, ixz, iyy, iyz, izz as attributes.

- geometry

The label describes the shape; `mesh` The main function of the attribute is to load the texture file, `filename` The file address of the attribute texture path. The label also includes other label descriptions:

```
<box size="1 2 3"/>     #box box, describe the length, width and height of
the box through the size attribute.
<cylinder length="1.6" radius="0.5"/>    #cylinder is cylindrical, the
height of the cylinder is described by the `length` property, and the radius
of the cylinder is described by the `radius` property.
<sphere radius="1"/>     #sphere is spherical, and the radius of the sphere
is described by the `radius` attribute.
```

- material

  The label describes the material; `name` Attributes are **required**, can be empty, and can be repeated. Through the [color] tag in `rgba` Attributes to describe red, green, blue, and transparency, separated by spaces. The range of colors is [0-1].

8.1.4 joints

1 Introduction

Describe the relationship between two joints, motion position and velocity limits, kinematic and dynamic properties.

Joint Type:

- fixed: fixed joints. Movement is not allowed and acts as a connection.
- continuous: Rotate the joint. It can be rotated continuously, and there is no limit to the rotation angle.
- revolute: Rotate the joint. Similar to continuous, there is a limit to the rotation angle.
- prismatic: sliding joints. Move along a certain axis, there is a position limit.
- floating: floating joints. With six degrees of freedom, 3T3R.
- planar: Planar joints. Allows translation or rotation above the plane orthogonal.

  2. sample code

```
< joint  name = "front_right_joint"  type = "continuous" >
      < origin  xyz = "0.08 -0.0845 -0.0389"  rpy = "-1.5703 0 3.14159" />
      < parent  link = "base_link" />
      < child  link = "front_right_wheel" />
      < axis  xyz = "0 0 1"  rpy = "0 0 0" />
      < limit  effort = "100"  velocity = "1" />
  </ joint >
```

In the [joint] tab `name` 属性是 **required**, describe the name of the joint, and are unique.

In the [joint] tab `type` Properties, corresponding to the six joint types.

  3. label introduction

- origin

  subtab, referring to the rotation joint in `parent` The relative position of the coordinate system.

- parent,child

The parent and child sub-labels represent two links to be connected; parent is the reference, and child rotates around the praent.

- axis

  The child label indicates which axis(xyz) the corresponding link of the child rotates around and the amount of rotation around the fixed axis.

- limit

  The child tag is mainly to limit the child. `lower` properties and `upper` The property limits the radian range of rotation, `effort` The property limits the force range during rotation. (positive and negative value, the unit is cattle or N) `velocity` The property limits the speed at which it turns, in meters/second or m/s.

- mimic

  Describes the relationship of this joint to existing joints.

- safety_controller

  Describe the safety controller parameters. Protect the movement of the robot joints.

8.2 URDF visualization

8.2.1. Start

```
roslaunch yahboomcar_description display.launch
```

8.2.2. Sample pictures

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 called the **base coordinate system**.Adjusting the [joint_state_publisher_gui] component can control the rotation of the wheel.