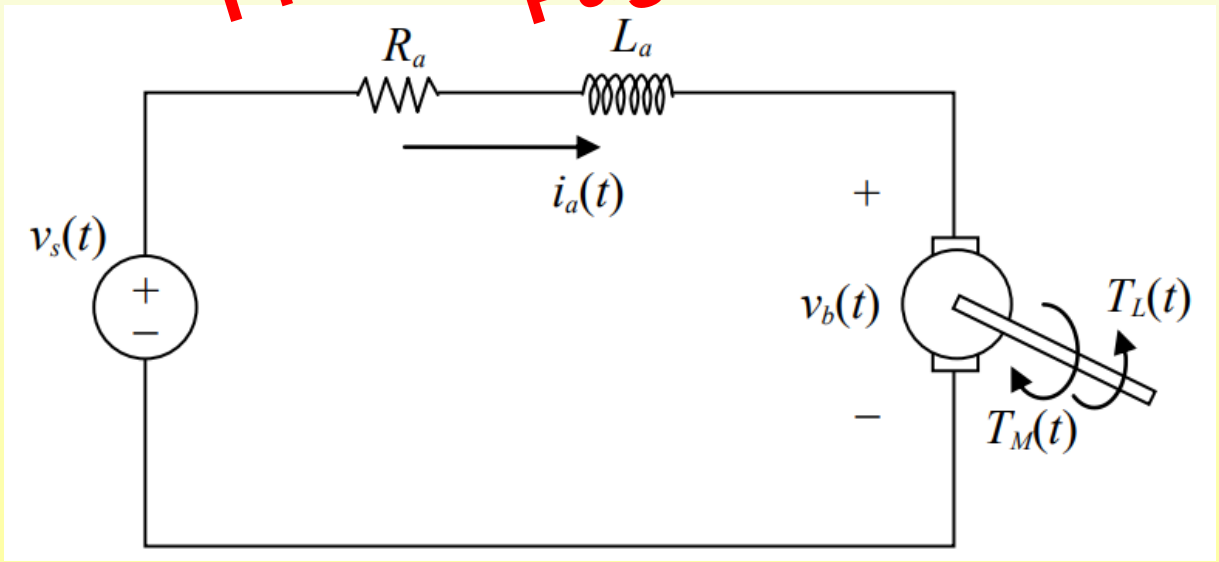
How to control DC motor?



- Understand its operation:
- $T_M = k_T i_a(t)$
- $v_b(t) = k_b \omega(t)$
- $R_a i_a(t) + L_a \frac{di_a}{dt} + v_b = v_s$
- Two control methods:
  - Voltage control
  - Current control

Fixed robot Structure

- The robot mechanical structure can be divided into three groups:
- The *Arm*

Responsible for positioning

- The Wrist

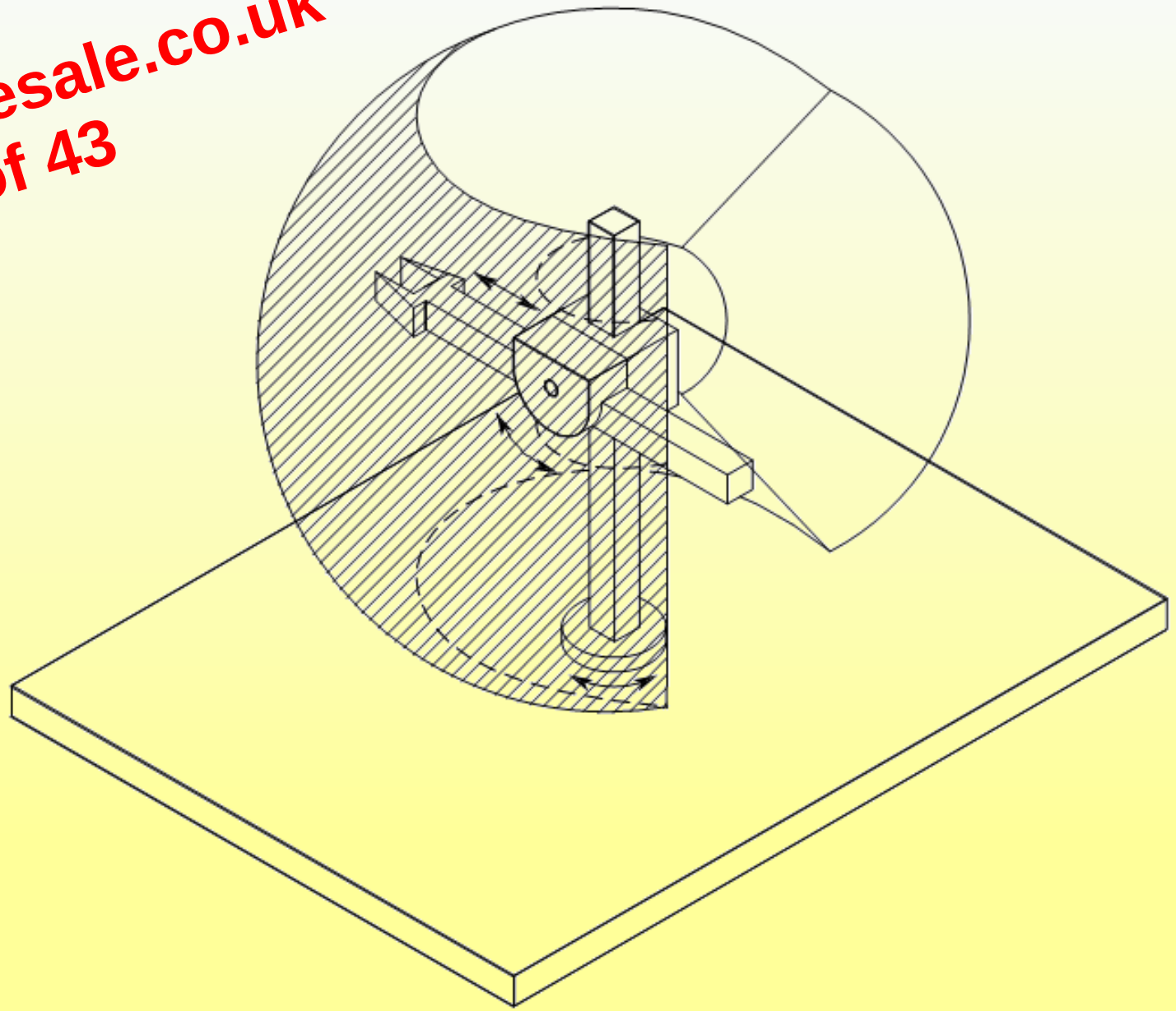
Responsible for orienting the end effector

- End effector

Performs the required action, e.g gripping, machining, painting, welding, … etc.

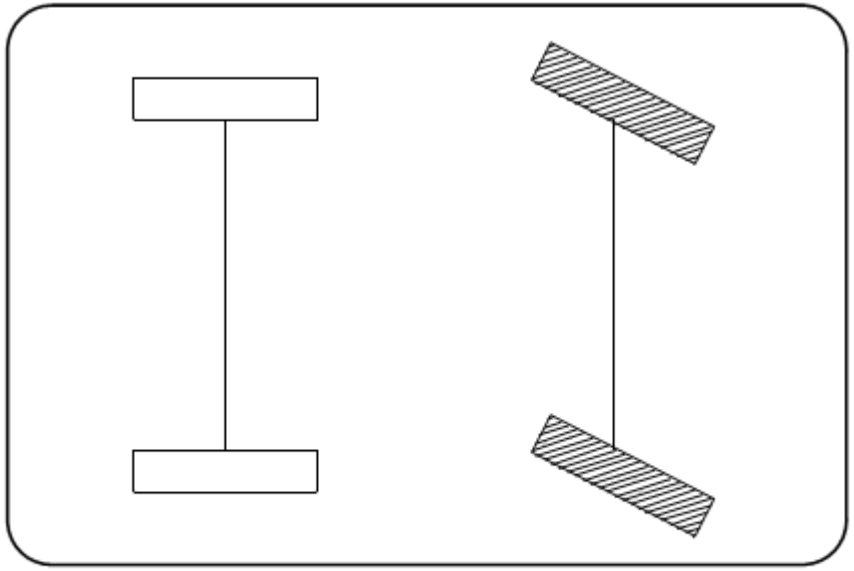
Spherical Manipulator

- 2 revolute joints + 1 prismatic joint.
- Has a spherical workspace



Wheeled robot mechanisms: Car like mobile robot

- The two rear wheels are fixed
- With a common shaft
- The two front wheels are steerable.
- Two actuators are needed
  - One actuator drives the rear (front) wheels
  - One actuator tilts the two front wheels



A car-like mobile robot

Components of a robotic system

- Mechanical structure

  A robot designer should design and build its mechanical structure, and find a mathematical model for it that relates the joint variables to the end effector pose (position and orientation).

- Planning

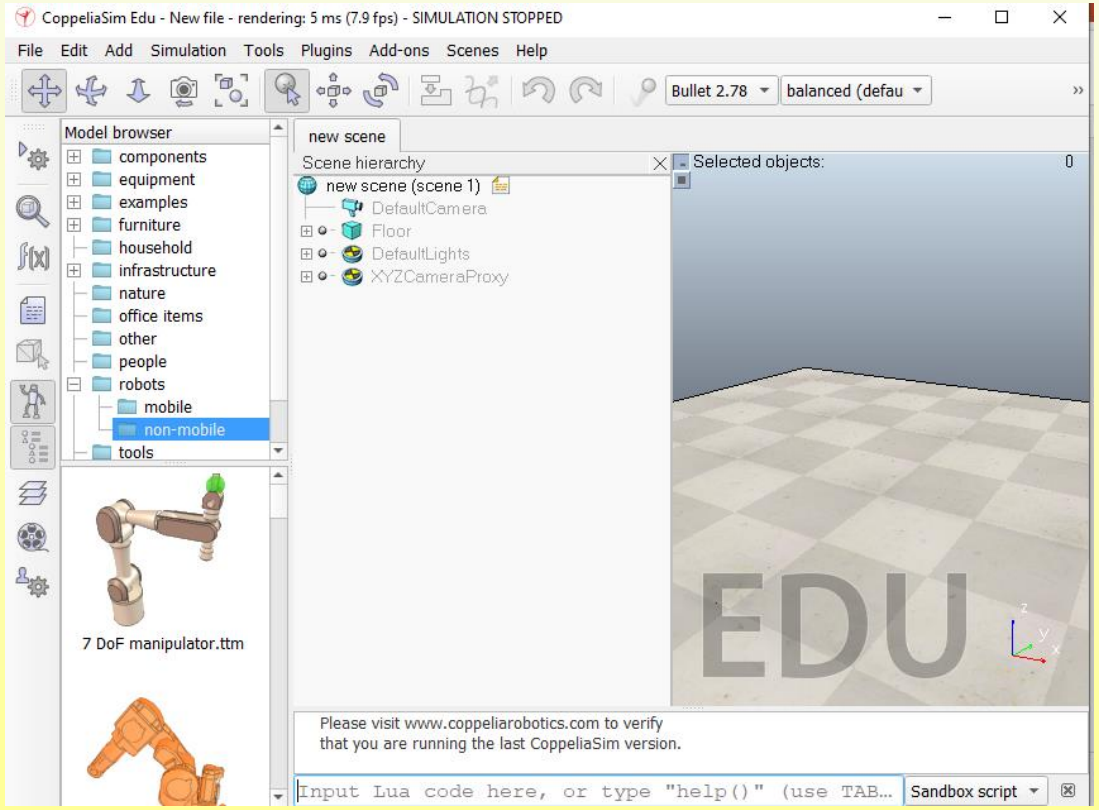
  A robot designer should plan the robot motion to follow a given ***trajectory*** and/or move from one pose to another.

- Control

  The robot designer should design a controller that calculates the actuated joint angles to achieve the required end-effector motion.

Robot simulator: Coppelia-sim

- It is used to create a virtual environment
- It has a large library of passive components and robots.
- Each robot can be controlled using a script.
- The simulation can be programmed using a variety of languages:
  - Lua
  - Python
  - C++
  - others



The End