Syllabus

Youngjin Choi, Room No. 231, 1st Engineering Building,
Department of Electrical and Electronic Engineering, Hanyang University,
Tel : 031-400-5232, e-mail : cyj@hanyang.ac.kr

- Subject : Modern Robotics

- Textbook : Modern Robotics by Lynch and Park

(Summary)

Robotics is a relatively young field with great goals. The ultimate goal of modern robotics is to develop machines that can act and decide like humans. Attempts to create intelligent machines begin with looking at the human structure, such as mechanism and the control structure of our bodies. The focus of this subject is on robot mechanism, motion planning, and intelligent control.

(Online Materials) http://modernrobotics.org/

(Schedule)

Chapter 2. Configuration Space

Chapter 3. Rigid Body Motion

Chapter 4. Forward Kinematics

Chapter 5. Velocity Kinematics

Chapter 6. Inverse Kinematics

Midterm Exam

Chapter 7. Kinematics of Closed-chains

Chapter 8. Dynamics of Open-chains

Chapter 9. Trajectory Generation

Chapter 10. Motion Planning

Chapter 11. Robot Control

Final Exam

(Grade)

Final Exam(40%) + Midterm Exam(40%) + HW(10%) + Attendance(10%) = 100%

제 1 장

Preview

- Ultimate goal of the robotics : the creation of machines that can behave and think like humans

    - why are our bodies designed like ours
    - how are our limbs coordinated (arms swing while walking)
    - how do we learn and perform complex tasks

- Our focus in the course is on mechanics, planning, and control for robot mechanisms.

    - mechanism is constructed by connecting the links (rigid bodies) by means of joints (relative motion b/w adjacent links)
    - actuation (electric motors) of the joints causes the robot to move and exert forces in desired ways.
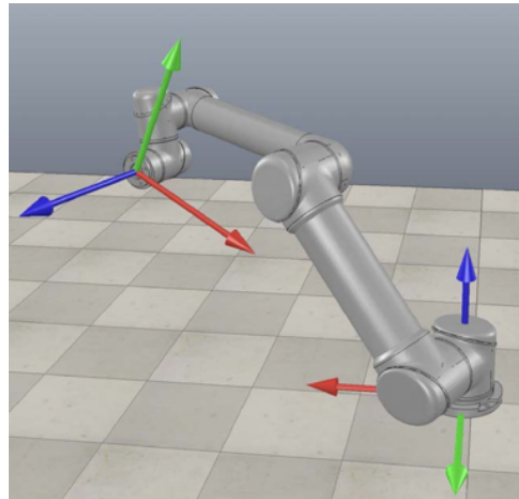
(a) An open-chain industrial manipulator, visualized in V-REP [154].
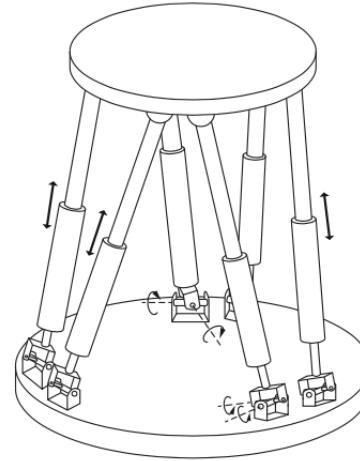
(b) Stewart–Gough platform. Closed loops are formed from the base platform, through the legs, through the top platform, and through the legs back to the base platform.

Figure 1.1: Open-chain and closed-chain robot mechanisms.

- Mechanisms can be classified as

  – open-chain when the links of a robot mechanism can be arranged in serial fashion (all the joints are actuated) - e.g., your arm when your hand is allowed to move freely in space.

  – closed-chain when the links form closed-loops (only a subset of the joints may be actuated). - e.g., a person standing with both feet on the ground.

- Actuators are classified as

    - DC or AC motors (speed reduction and torque amplification are required)
    - stepper motors
    - shape memory alloys,
    - pneumatic cylinders,
    - hydraulic cylinders,

- Examples of transmissions or transformers include

    - gears
    - cable drives
    - belts and pulleys
    - chains and sprockets

- Backlash (the amount of rotation available at the output of the speed-reduction device w/o motion at the input) appears in these transmissions

- Brakes may also be attached to stop the robot quickly or to maintain at stationary posture.

- Sensors

    - for both revolute and prismatic joints, encoders, potentiometers, or resolvers, sometimes tachometers
    - for forces and torques, joint torque sensor, force/torque sensor at the end-effector of the robot
    - for localization of objects and robots, vision-based cameras, RGB-D cameras, laser range finders, acoustic sensors

- The robotics often includes artificial intelligence and computer perception.