Robotics - 機器人學

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Contents

Chapter 1- Introduction

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1.1 Introduction

- □ What can be called a "robot"?
  - ◘ A system with *Mobility* and *Autonomy*

- □ Why use robots?
  - ◘ To reduce costs
  - ◘ To increase productivity and quality
  - ◘ To operate in hostile environments
  - ◘ No strike
  - ◘ CAD/Robot integration
    (Calibration and task feasibility)

1.1 Introduction

- Where can Robots be seen?
  - Shipping, Painting, Transferring, Die-casting, Welding, Assembling, Measuring, Holding

- What does robot perform well? What does not?
  - Good: position control
  - Bad: vision, force control
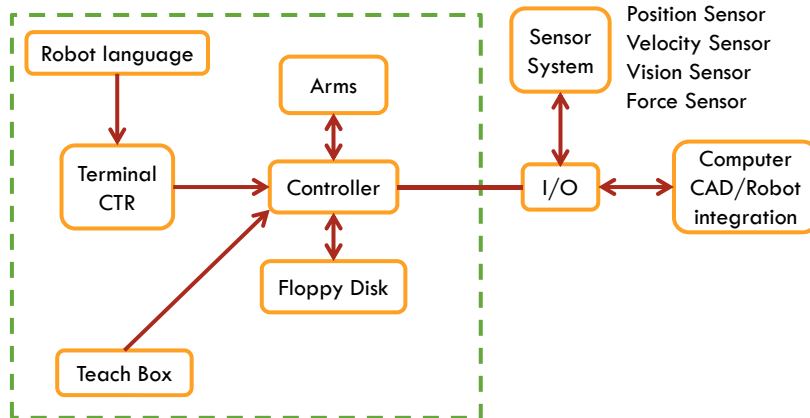
1.2 References

- Journals:
  - IEEE Trans. on Robotics & Automation
  - IEEE Trans. on System, Man, Cybernetics
  - IEEE Trans. on Mechatronics
  - IEEE Rob. & Aut. Magazine
  - IEEE Control System Magazine
- Conference:
  - IEEE Int. Conf. on Rob. & Aut.
  - IEEE Int. Conf. on Systems, Man, Cybernetics
  - IEEE Conf. on Decision and Control

1.3 Robot System

1.3 Robot System

- **Arm:**
  - 3 or 4, 5, 6, and redundant, plus gripper
- **Joint:**
  - Revolute, Prismatic (平行軸)
- **Actuator:**
  1. Electrical motor
  2. Hydraulic actuator (油壓)
  3. Pneumatic actuator (汽壓)
- **Drive:** Direct drive, Gear/Belt transmission
- **Internal sensors:**
  1. Encoder for position
  2. Tachometer for velocity

1.4 Robot Simulator

Robot task

↓

Trajectory Planning

↓ $q_d, \dot{q}_d$

Feedback / Feedforward control

↓ Torque (F=ma)

Dynamic Equations

$$F = ma$$
$$T = H(q) \cdot q + H(q, \dot{q}) + G(q)$$

↓ $\ddot{q}_d$

Motion Integration