



Course	MAE3060 Introduction to Robotics
Class Time	09:30-12:15 Tue, Wed, Thur
Instructor	Dr. Kai Ming Kiang Department of Mechanical and Automation Engineering The Chinese University of Hong Kong
E-mail	To be provided

Course Description
Robot classification and specification. Coordinate frames and homogeneous transformations. Denavit-Hartenberg notation. Forward and inverse kinematics. Differential motion. Jacobians and statics. Singularity. Actuators, sensors, and end effectors. Trajectory generation. Introduction to robot motion planning. Equivalent to ACE2140.
Course Objective(s)
<ul style="list-style-type: none">• Understand the homogeneous coordinate transformation• Know how to derive the forward kinematics of robot manipulator• Be familiar with the inverse kinematics of robot manipulator• Understand the Jacobian matrix, the velocity relationship, and force relationship• Be familiar with sensors and actuators• Understand trajectory planning and robot motion planning• Be knowledgeable with human-robots interfaces
Required Textbook(s)
Introduction to Robotics: Mechanics and Control, 3rd edition, John J. Craig, Prentice Hall, 2005
Reading(s)/Reference(s)
<ul style="list-style-type: none">• Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku, Prentice Hall, 2001.• Principles of Robot Motion: Theory, Algorithms and Implementation, Howie Choset, et al., The MIT Press, 2005• In-class Handouts
Course Requirements/Evaluation
Assignments: 35% Mid-Term Exam: 25% Final Exam: 40%
Course outline
1. Introduction Course outline Robot definition Industrial applications of robots Classification of robots

2. Homogeneous transformation
 - Coordinate frames
 - Rotation matrix
 - Rotational axes
 - Coordinate transformation
 - Homogeneous transformation matrix
 - Representation of position and orientation
3. Forward kinematics
 - D-H method
 - Kinematic parameters
 - Derivation of forward kinematics
4. Inverse kinematics
 - Solution of inverse kinematics
5. Jacobian matrix
 - Derivation of Jacobian matrix
 - Singular Configuration
 - Velocity relationship
 - Force relationship
6. Trajectory planning and motion planning
 - Velocity profiles
 - Introduction to robot motion planning
 - Configuration space
7. Sensors and actuators
 - Position sensors
 - Force sensors
 - DC motors
8. Human-robot interfaces
 - Force-reflecting systems
 - Haptic interactions
9. Project demonstration and presentation

Others

Academic Honesty

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at <http://www.cuhk.edu.hk/policy/academichonesty>. All university, faculty, and department policies on academic honesty will be strictly enforced. The usual consequence of academic dishonesty is failure of the course and referral of the case to the University authorities for additional disciplinary action. Tests are individual work and are to be completed without outside assistance of any sort.