THE UNIVERSITY OF BRITISH COLUMBIA
Department of Mechanical Engineering
MECH 42X Introduction to Mechatronics

Course Information

INSTRUCTOR
Dr. Xiaodong Lu, Kaiser 3103; XDLU@mech.ubc.ca; Office hours: Friday 4-5pm.

PREREQUISITES: MECH 2, MECH 305, MECH 368

LECTURES
- Introduction to mechatronics systems, with emphasis on understanding of working principles, development of analytical and modeling skills, and getting hands-on experience; passive and active electronic components characterization and performance analysis; Op-amp based signal conditioning and instrumentation; various commonly used actuators, including voice coil motors, variable reluctance actuators, DC motors, brushless motors, motor commutation and control algorithm, linear motors, and step motors; Power amplifiers for actuators; various commonly-used sensors, including resistive, inductive, capacitive, and optical sensors for force and position measurement.

COURSE GRADING
Homeworks(10%)+ Quiz 1(25%)+ Quiz 2(25%)+Final exam(40%)

TEXTBOOK
No required textbook. Lecture notes will be handed to students.
Suggested reading reference: Design of High Performance Mechatronics, 2nd Edition.

EXAMS
- Quiz 1: Oct 12th in lecture. 1 page of note (Letter-size, double-sided) allowed, in class.
- Quiz 2: Nov 7th in lecture. 1 page of note (Letter-size, double-sided) allowed, in class.
- Final exam: 2.5hrs. 2 pages of note allowed (Letter-size, double-sided).

Lecture Outline

Week	Lecture	Assignment
1	Introduction to mechatronics systems and examples; Passive electronic components, electrical network	
2	Circuit analysis in time domain Circuit analysis in frequency domain	HW1
3	Active electronics; Ideal Operational amplifier; Voltage follower; Non-inverting input circuit;	
4	Instrument Amplifier; Practical operation amplifier: OP27 Gain-bandwidth product; Closed-loop bandwidth;	HW2
5	Resistive sensors; Capacitive sensors;	
6	Inductive sensors; Optical sensors	HW3
7	Voice coil actuator, Magnetic materials; Magnetic circuit analysis	
8	Reluctance Actuator; Comparison between reluctance actuator and voice coil actuators; Mid-term exam	HW4
9	DC motor design and configuration, DC motor force analysis DC motor commutation	
10	3-phase brushless motor 2-pole 3 phase brushless motor with trapezoidal control Hall-effect sensor for commutation	HW5
11	Brushless motor with sinusoidal commutation Multi-pole brushless motors Linear motors	
12	Reluctance step motors Permanent magnet step motors Hybrid step motor	HW6
13	Power electronics Switching amplifier, H-bridge, PWM control Linear amplifier, Current sensing. motor current control	