國立清華大學
National Tsing Hua University

PME 535200 Vibration Control

振動控制

Spring 2022

Instructor:	Prof. Jen-Yuan (James) Chang 張禎元 教授	Credits:	3 credits.
Class meetings:	**F5F6F7**	Office hours:	Friday 17:00-18:00

Goal: To gain a physical and mathematical understanding of to use design and control techniques to control vibrations and dynamics of mechanical systems through understanding of passive-active vibration controls, discrete-time state variable representations, pole placement via state-feedback, introduction to realization and linearlization of vibration problem into control system, controllability and observability theory, observer and estimator designs, introduction to Kalman filtering; linear quadratic regulator theory and digital control. Along with the classroom teaching, students will need to complete several laboratory assignments, in which assignment the taught theories and numerical modeling and simulation will be integrated to control modeled vibration and dynamic systems.

Textbook: Lecture notes/materials provided by Professor Chang.

L. Meirovitch, *Analytical Methods in Vibrations*, Macmillan

G.F. Franklin, J.D. Powell, and A. Emami-Naeini, "Feedback Control of Dynamic Systems," Pearson Education Limited.

Reference: Control Tutorials for MATLAB and SIMULINK, W.C. Messner and D.M. Tilbury, Addison-Wesley.
Modern Control Engineering, 3rd edition, by Katsuhiko Ogata.

Teaching Method: Classroom lectures will be offered in both Chinese and English with teaching materials posted in NTHU eLearn.

Topics to be covered:

1. Vibrations of discrete systems
2. Vibrations of continuous systems
3. Passive and active vibration controls
4. Control-mechatronics – sensors, actuators and micro-controller
5. State space representation of system
6. Analysis of state equation
7. Controllability and observability of linear system
8. Pole assignment of controllable system
9. Design of estimator for observable system
10. Introduction to digital control
11. Lyapunov stability criterion
12. Introduction to nonlinear control

Assessments:

Labs	35%	3 laboratory assignments, 2-3 students per group.
Term project	20%	2-3 students per group.
Midterm exam	20%	In-class individual effort, closed book and notes.
Final exam	25%	In-class individual effort, closed book and notes.

Prof. Jen-Yuan (James) Chang
Telephone: +886-03-574-2498 ❖ Office: Engineering Building I – R509 ❖ Email: jychang@pme.nthu.edu.tw