

- Course Number and Title: M E 527. Linear Systems Theory
- Catalog Description: Introduction to control of linear multi-input-multi-output (MIMO) systems. Topics include representation of system dynamics using the state-space model, linearization, internal and input-to-output stability, controllability, observability, optimal control, linear quadratic regulator, and observer.
- Credit Hours: 3 Credits (3)
- Prerequisite(s) / Corequisite(s): Prerequisite(s): M E 452 or Consent of Instructor
Corequisite(s): None
- Required: Graduate Core
- Course Availability: Spring Semester
- Instructor (Usual): Dr. Liang Sun (See <https://mae.nmsu.edu/people/faculty.html>)
- Textbook:
 - 1) C.-T. Chen. *Linear Systems Theory and Design*. Oxford University Press; 4th Ed., November 14, 2012 (ISBN-10: 0199959579; ISBN-13: 978-0199959570)
 - 2) J. Hespanha. *Linear Systems Theory*. Princeton University Press; 2nd Ed., February 13, 2018 (ISBN-10: 0691179573; ISBN-13: 978-0691179575).
- Course Learning Objectives: After completing this course, a student should be able to:
 - 1) Model linear dynamical systems using state space methods.
 - 2) Analyze stability, controllability, and observability of linear systems.
 - 3) Design controllers and observers for linear systems using pole placement methods.
- Topics Covered:
 - SS representation, Lagrange Equation
 - Causality, LTI, convolution, TF of S-S system
 - Solution of LTI and LTV systems
 - Lyapunov Stability, Input-Output Stability
 - Optimal Control
 - Differential Flatness Based Quadcopter Control
 - LTI Controllability and Observability
 - LTV Controllability & Observability, State Feedback
 - Regulation and Tracking, State Estimator
 - Digital Control: Low-Pass Filter , Kalman Filter
 - Robust Tracking with Disturbance