Linear Control Systems
Course Code: EE-871

Course Description

The course starts with examples on modeling of physical systems. Thereafter the description of linear time-invariant and time-variant systems using transfer functions and state space models is introduced. Analysis and synthesis of linear feedback systems follow thereafter. At the end the course addresses questions regarding the design of control systems, such as control system architectures and mechanisms that counteract integration windup.

Text Book:

William L. Brogan, Modern Control Theory, Pearson, Third Edition, 1990.

Reference Book:

1. Joao Hespanha, Linear Systems Theory, Princeton University Press, First Edition 2009.
2. Thomas Kailath, Linear Systems, Prentice-Hall, First Edition, 1980
3. Chi-Tsong Chen, Linear Systems Theory and Design, Oxford University Press, Third Edition, 1998
4. Bernard Friedland, Control System Design: An Introduction to State-Space Methods, Dover Publications, 2005

Prerequisites

Linear Algebra and Differential Equations.

ASSESSMENT SYSTEM

Quizzes	15%
Assignments	10%
Mid Terms	30%
ESE	45%

Teaching Plan

Week No	Topics	Learning Outcomes
1	Introduction	Course Outline, objectives, teaching plan, assessment method, concepts review

2-6	Modeling	State-space Representation, Linearization, Realization Theory, Dynamical Systems, Linear Systems, Linear Algebra Review, The State Transition matrix, Matrix Exponentials, Cayley-Hamilton Theorem
7-11	Analysis	Stability, Controllability, Observability, Duality, Kalman Decomposition, Minimality
	MIDTERM IN WEEK 9	
12-17	Control Design	State Feedback, Output Feedback, Separation Principle, Pole Placement, LQR Optimal Control, Optimal Estimation, Kalman Filter, Beyond Linear World!
18	**End Semester Exams**	