Welcome to

KOM3712 Control Systems Design

Spring 2019

Şeref Naci Engin

Yildiz Technical University
Faculty of Electrical & Electronics
Control and Automation Engineering Dept.
Davutpasa Campus
Esenler, Istanbul, Turkey 34320

e-mail: nengin@yildiz.edu.tr
http://www.yildiz.edu.tr/~nengin/
T: +90 212 383 5960
F: +90 212 383 59 59
Office: A-015

KOM3712 Control Systems Design

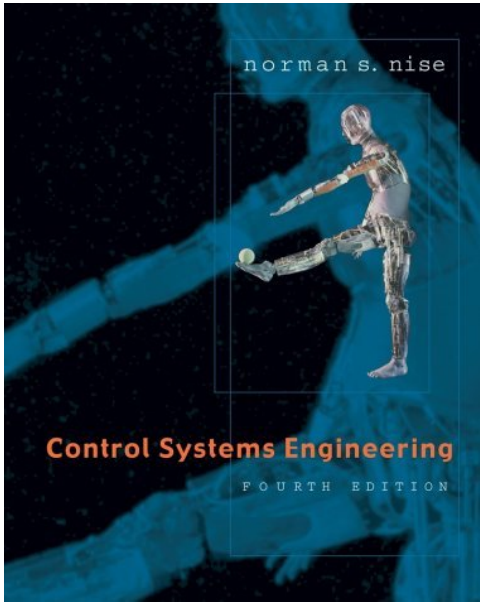
- **Instructor:** **Şeref Naci Engin**
- **Assistant:** **Esra Kaya Ayana**
- **Office Hours:** **Wednesdays 2:00 – 4:00 pm and drop-in based short visits**
- **Grading:**
  - Midterm exam 1 X 30%
  - Assignments 2 X 15%
  - Final exam 40%

only individual submissions allowed!

- **Attendance min. 70%, plus assignments and quizzes**

Textbooks

- **N. S. Nise, Control Systems Engineering, 6th edition, John Wiley & Sons, MA, 2011**.
- G. F. Franklin, J. D. Powell, and A. Emami-Naeini, Feedback Control of Dynamic Systems, 6th edition, Prentice Hall, NJ, 2010
- K. Ogata, Modern Control Engineering, 5th edition, Prentice Hall, NJ, 2010
- C.L. Phillips, and J. Parr, Feedback Control Systems, 5th Ed., Prentice-Hall, 2010.
- F. Golnaraghi and B. C. Kuo, Automatic Control Systems, 9th edition, John Wiley & Sons, NJ, 2010 (This book is available in Turkish by A. Bir, Literatür Yayıncılık)
- J. J. D'Azzo, C. H. Houpis, and S. N. Sheldon, Linear Control System Analysis and Design with Matlab, 5th edition, Marcel Dekker, 2003



KOM 3712 – Topics by weeks

Week-1	Recap. of Control Systems, RL based design for Cascaded and Fb Controllers, PID tuning by Ziegler-Nichols, issues in PID implementations
Week-2	Intro. to **Frequency Response Techniques**, Analytical Expressions, Plotting Frequency Response, Bode Plots
Week-3	Bode Plots of 2^{nd} Order Systems, Corrections to Second-Order Bode Plots, Bode plots for higher order systems, Nyquist Diagrams
Week-4	The Nyquist Criterion, Applying the Nyquist Criterion to Determine Stability, Sketching the Nyquist Diagram, Stability via the Nyquist Diagram, Range of Gain for Stability via The Nyquist Criterion, Stability via Mapping Only the Positive $j\omega$-Axis, Gain Margin and Phase Margin via the Nyquist Diagram
Week-5	Stability, Gain Margin, and Phase Margin via Bode Plots, Range of Gain for Stability via Bode Plots, Evaluating GM and PM, Examples
Week-6	Relation Between Closed-Loop Transient and Closed-Loop Frequency Responses, Response Speed and Closed-Loop Frequency Response, Relation Between Closed- and Open-Loop Frequency Responses, **Constant *M* Circles** and **Constant *N* Circles**, Relation Between Closed-Loop Transient and Open-Loop Frequency Responses

KOM 3712 – Topics by weeks, *cont'd…*

Week-7	Damping Ratio **From *M* Circles**, Damping Ratio From PM, Response Speed from Open-Loop Frequency Response, Steady-State Error Characteristics (K_p, K_v, K_a) from Frequency Response, Systems with Time Delay, Obtaining Transfer Functions Experimentally
Week-8	**Design via Frequency Response**, Transient Response via Gain Adjustment, Lag Compensation Design, Lead Compensation Design, Lag-Lead Compensation Design
Week-9	Midterm-1
Week-10	**Design via State Space**, State space representations for dynamic systems, Canonical Forms, Controllability, Observability
Week-11	Controller Design, Alternative Approaches to Controller Design, Pole Placement / Assignment, Example Problems, Design of Servo Systems
Week-12	State Observers, Design of Regulator and Control Systems with Observers
Week-13	Steady-State Error Design via **Integral Control**, Case Study - Antenna Control: Design of Controller and Observer
Week-14	**Digital Control Systems**, Signal Types, Digitalization, z-Transform, Stability, Steady-State Errors, Transient Response on the z-Plane, Gain Design, Digital PID Design, Implementing the Digital Controllers