1. ECE 412: Digital Control and Digital Filters

2. 3 credits: 2-75 minute lecture sessions/week

3. Mahmood R Azimi-Sadjadi

4. Digital Control System Analysis and Design. Phillips, C.L. & Nagle, H. T. 2015.

5. Course Information
    a. FIR and IIR digital filter design, analog and digital invariance and direct digital control algorithms, hybrid systems analysis
    b. Prerequisites: ECE 411
    c. Selected Elective: Computer Engineering; Electrical Engineering

6. Goals for the Course
    a. Course Learning Objectives
        i. Establish their theoretical foundations and knowledge in digital control and digital filters
        ii. Achieve in-depth understanding of different analysis and design methods for these systems
        iii. Understanding and appreciations of the applications of the covered methods in both control systems and to some degree digital signal processing areas,
        iv. Gain hands-on software implementation of some design and analysis algorithms in two computer assignments
        v. Be able to evaluate and analyze their results in different computer assignments
        vi. Enhance their written communication and presentation skills by preparing computer assignment reports.
    b. Student Outcomes
        1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
        2. An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and welfare, as well as global, cultural, social, environmental, and economic factors
        6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. Topics Covered
    Digital control systems
    Z-transform
    Z-domain solution of linear time- invariant (LTI) systems
    Sampling and reconstruction
    Digital filter design steps
    Discrete-time systems and representation
    Open-loop discrete-time systems
    Closed-loop discrete-time systems

Time-domain analysis
Digital controller design
State-space representation
Stability, controllability and observability of digital control systems
Digital compensator design using classical and modern approaches