OPTIMAL CONTROL

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PRE-REQUISITES : Advanced Control System.

INTENDED AUDIENCE : It is an Elective Course forPG, Research Engineers, Scientists, Non Ph.D Faculties.

INDUSTRIES APPLICABLE TO : DRDO, ISRO and Engineering Institutions etc.

COURSE OUTLINE :

The optimization techniques can be used in different ways depending on the approach (algebraic or geometric), the interest (single or multiple), the nature of the signals (deterministic or stochastic), and the stage (single or multiple). The main objective of optimal control is to determine control signals that will cause a process (plant) to satisfy some physical constraints and at the same time extremize (maximize or minimize) a chosen performance criterion (performance index or cost function).

ABOUT INSTRUCTOR :

Prof. Barjeev Tyagi received the PhD in Electrical Engineering, IIT-Kanpur, 2005 and M.Tech Electrical Engineering (Control System) from IIT-Kharagpur in the year 2000. Prior to these he completed his B. E. Electrical Engineering from IIT-Roorkee (Formally Univ. of Roorkee) in 1987. Presently he is serving as Associate Professor in EED, IIT-Roorkee since 2007. His research interests include Control System Analysis and Design, Control application in Power System, Distributed Generation and Control.

COURSE PLAN :

Week 1 : Introduction and Performance Index
    Basic Concept of calculus of variation
    Fixed end point problem
    Free end point problem
Week 2 : Free end point problem (Continued)
    Free end point problem (Continued)
    Free end point problem (Continued)
    Optimum of a function with conditions
    Optimum of Functions with Conditions
    (Lagrange Multiplier Method)
Week 3 : Optimum of a functional with conditions
    Variational Approach to Optimal Control Systems
    Variational Approach to Optimal Control Systems (continued)
    Linear Quadratic Optimal Control Systems
    Linear Quadratic Optimal Control Systems (Contnued)
Week 4 : Linear Quadratic Optimal Control Systems (Contnued)
    Linear Quadratic Optimal Control Systems (Contnued)
    Linear Quadratic Optimal Control Systems (Contnued)
    Linear Quadratic Optimal Control Systems
    (Optimal Value of Performance Index)
    Infinite Horizon Regulator Problem
Week 5 : Infinite Horizon Regulator Problem (Continued)
    Analytical Solution of Matrix Differential Riccati Equation (State Transition Matrix Approach)
    Analytical Solution of Matrix Differential Riccati Equation (Similarity Transformation Approach)
    Analytical Solution of Matrix Differential Riccati Equation (Similarity Transformation Approach) (Continued)
    Frequency Domain Interpretation of LQR
    (Linear Time Invariant System)
Week 6 : Frequency Domain Interpretation of LQR
    (Linear Time Invariant System) (Continued)
    LQR with a Specified Degree of Stability
    Inverse Matrix Riccati Equation
    Linear Quadratic Tracking System
    Discrete-Time Optimal Control Systems

Week 7 : Discrete-Time Optimal Control Systems (Continued)

        Discrete-Time Optimal Control Systems (Continued)

        Matrix Discrete Riccati Equation

        Analytical Solution of Matrix Difference Riccati Equation

        Analytical Solution of Matrix Difference Riccati Equation (Continued)

Week 8 : Optimal Control Using Dynamic Programming

        The Hamilton-Jacobi-Bellman (HJB) Equation

        LQR System Using H-J-B Equation

        Time Optimal Control System

        (Constrained Input)

        Time Optimal Control System(Continued)