ADVANCED LINEAR CONTINUOUS CONTROL SYSTEMS: APPLICATIONS WITH MATLAB PROGRAMMING AND SIMULINK

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INTENDED AUDIENCE : All Engineering Student/Faculty

COURSE OUTLINE :

Today, there is an utmost need to understand advanced control engineering on account of its multidisplinary applications in various areas of engineering. The main thrust in this course is on fundamentals of advanced linear continuous control system. In this course, various methodology of modelling in state space, state transition matrix and solution in state equation will be studied. Further, stability analysis issues in state space will be discussed. Finally, the concepts of controllability, observability, controller design, and observer design will also be discussed. The theory is supported by numerical examples, practical examples and Matlab programming. Important For Certification/Credit Transfer.

ABOUT INSTRUCTOR :

Prof. Yogesh Vijay Hote is an Associate Professor in the Department of Electrical Engineering at Indian Institute of Technology, Roorkee. He received B. E. degree in Electrical Engineering from Government College of Engg., Amravati, Amravati University in 1998 and M.E. degree in Electrical Engineering with specialization in Control Systems from Government College of Engg., Pune, Pune University in 2000. He also received Ph.D degree in Instrumentation and Control Engineering., Faculty of Technology, University of Delhi, in 2009. Prof. Hote has nearly 17 years of teaching and research experience. His main fields of expertise include robust controller design, model order reduction techniques and their applications in load frequency control, dc-dc converters and robotic systems. He is teaching courses related to control systems in Electrical Engineering department, IIT Roorkee from seven year. He has guided 5 Ph.D research scholars & 20 M.Tech students and 4 Ph.D research scholars & 4 M.Tech students are under process. He has published 80 articles in reputed journals and conferences. He has also published a monograph related to stability analysis of uncertain systems.

COURSE PLAN :

Week 1 : 1 Introduction to State Space
2 State Space Representation
3 State Space Representation: Companion Form (Controllable Canonical Form)
4 State Space Representation :Extended Controllable Canonical Form
5 State Space Representation :Observable Canonical Form

Week 2 : 1 State Space Representation: Diagonal Canonical Form (Part I)
2 State Space Representation: Diagonal Canonical Form (Part II)
3 State Space Representation: Jordan Canonical Form
4 State Space Representation: Numerical Examples on State Space Modelling (Part I)
5 State Space Representation: Numerical Examples on State Space Modelling (Part II)

Week 3 : 1 Modelling of Mechanical Systems in State Space
2 Modelling of DC Servo Motor (Part I)
3 Modelling of DC Servo Motor (Part II)
4 Determination of Transfer Function from State Space Model (Part-I)
5 Determination of Transfer Function from State Space Model (Part-II)

Week 4 : 1 Stability Analysis in State Space:Concept of Eigenvalues and Eigenvectors (Part I)
2 Stability Analysis in State Space (Part II)
3 Stability Analysis in State Space:Lyapunov Stability Analysis (Sylvester's Criterion) (Part III)
4 Stability Analysis in State Space:Lyapunov Stability Analysis (Stability Criterion) (Part IV)
5 Stability Analysis in State Space:Lyapunov Stability Analysis (Direct Method) (Part V)

Week 5 : 1   Concept of Diagonalization

2   Solution of State Equation

3   Solution of State Equation (Forced system)

4   Steady State Error for State Space System

5   State Transition Matrix (Part-I)

Week 6 : 1   State Transition Matrix (Part-II)

2   State Transition Matrix using Caley Hamilton Theorem (Part-III)

3   MATLAB Programming with State Space

4   Controllability in State Space (Part-I)

5   Controllability in State Space (Part-II)

Week 7 : 1   Observability in State Space (Part-I)

2   Observability in State Space (Part-II)

3   Pole Placement by State Feedback (Part-I)

4   Pole Placement by State Feedback (Part-II)

5   Pole Placement by State Feedback (Part-III)

Week 8 : 1   Tracking Problem in State Feedback Design (Part-I)

2   Tracking Problem in State Feedback Design (Part-II)

3   State Observer Design (Part-I)

4   State Observer Design (Part-II)

5   State Observer Design (Part-III)