ADVANCED PROCESS CONTROL

Course Code: 13CH2112

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Prerequisites: The student should have knowledge of basics of control system and Laplace transforms.

Course outcomes:

On successful completion of the course, the student should be able to

CO1 : Design / tune a controller for SISO systems and assess the stability of a closed – loop system by Routh – stability criteria, Bode & Nyquist stability criteria.

CO2 : Develop internal model control structure and design IMC for stable and unstable processes.

CO3 : Select proper input – output pairings for Multiple single input – single output controller by the application of Relative Gain Array technique and Design Ideal Decouplers for MIMO systems.

CO4 : Differentiate between different Model Predictive Control Algorithms.

CO5 : Formulate the state space representation of the system and apply z- transforms to discrete systems.

UNIT-I

Review of single input single out put (SISO) systems, Routh stability criteria. Frequency Response Analysis: Bode and Nyquist plots, effect of process parameters on Bode and Nyquist plots, closed loop stability concepts, Bode and Nyquist Stability (only Qualitative Treatment).

UNIT-II

Internal Model control: Introduction to model based control, practical openloop controller design, generalization of the open-loop control design procedure, model uncertainty and disturbances. The IMC structure, IMC design procedure, effect of model uncertainty and disturbances. IMC in context of PID controller.

UNIT-III

Control-loop Interaction: Introduction, Motivation, the general pairing problem, the relative gain array, properties and application of the RGA. Multivariable Right Half Plane (RHP) Zeros and their performance limitations, Design of ideal Decouplers.

UNIT-IV

Model Predictive Control: Model forms of model predictive control, constrained and unconstrained approach, analysis of dynamic matrix control.

UNIT-V

State space and transfer function representation and their interrelationships. Sampling and Z-transforms, Open loop and closed loop response.

TEXT BOOKS

1. Wayne Bequette B., *"Process control: Modeling, Design and simulation",* PHI, 2003.

2 Stephanopoulos,*"Chemical Process Control: An Introduction to Theory & Practices",*PHI,2010

REFERENCES:

1. Ogunnaike, B,. Ray W H, *"Process Dynamics, Modeling and Control",* Oxford University Press, 1994.

2. Seborg D.E. and Edgar T.F., Mellichamp D.A *"Process Dynamics and control",* Wiley, 2006.

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