



Control Systems

Time: 3 Hours

Max. Marks: 100

Note : Answer any five questions choosing one full question from each unit.

Unit - I

- 1 a) Draw the block diagram representation of an open loop and a closed loop control system and explain each block. Indicate two advantages, two demerits and two applications of each type. 8
- b) Find $\frac{C(s)}{R(s)}$ for the system shown in Fig. 1(b) using i) Block diagram reduction ii) Mason's gain formula.



Fig. 1(b)

12

OR

- 2 a) What are block diagram and signal flow graphs? How are they obtained for a system? 8
- b) For the mechanical system shown in Fig. 2(b) obtain: i) Mechanical network ii) Mathematical model iii) f-V analog circuit iv) f-i analog circuit.

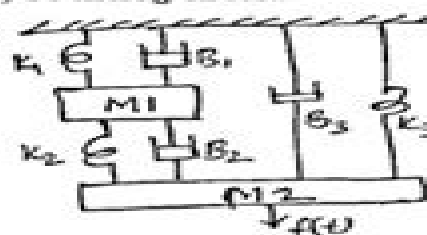


Fig. 2(b)

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Unit - II

- 3 a) Discuss the effect of damping ratio on the step response of a second order system with relevant equations and graphs. 8
- b) Derive the expressions for the peak time and maximum overshoot of the step response of a second order underdamped system. If the OLTF of a unity feedback system is $G(s) = \frac{4}{s(2s+1)}$ find rise time, peak time and maximum overshoot. 12

OR

- 4 a) Explain the basic PI, PD and PID control actions with relevant transfer functions. 8
- b) Derive the expressions for the position, velocity and acceleration error constants of a unity feedback system. A unity feedback system has the forward path transfer function $G(s) = \frac{K(2s+1)}{s(5s+1)(s+1)^2}$. Find the minimum value of K, so that the steady state error is less than 0.1, when input is $r(t) = 1+6t$. 12

Control System Previous Question Paper

L Darling-Hammond



Control System Previous Question Paper:

Control System Theory Uday A. Bakshi, 2020-12-01 The book is written for an undergraduate course on the theory of Feedback Control Systems. It provides comprehensive explanation of theory and practice of control system engineering. It elaborates various aspects of time domain and frequency domain analysis and design of control systems. Each chapter starts with the background of the topic. Then it gives the conceptual knowledge about the topic, dividing it in various sections and subsections. Each chapter provides the detailed explanation of the topic, practical examples and variety of solved problems. The explanations are given using very simple and lucid language. All the chapters are arranged in a specific sequence which helps to build the understanding of the subject in a logical fashion. The book starts with explaining the various types of control systems. Then it explains how to obtain the mathematical models of various types of systems such as electrical, mechanical, thermal, and liquid level systems. Then the book includes good coverage of the block diagram and signal flow graph methods of representing the various systems and the reduction methods to obtain simple system from the analysis point of view. The book further illustrates the steady state and transient analysis of control systems. The book covers the fundamental knowledge of controllers used in practice to optimize the performance of the systems. The book emphasizes the detailed analysis of second order systems as these systems are common in practice and higher order systems can be approximated as second order systems. The book teaches the concept of stability and time domain stability analysis using Routh-Hurwitz method and root locus method. It further explains the fundamentals of frequency domain analysis of the systems including correlation between time domain and frequency domain. The book gives very simple techniques for stability analysis of the systems in the frequency domain using Bode plot, Polar plot, and Nyquist plot methods. It also explores the concepts of compensation and design of the control systems in time domain and frequency domain. The classical approach loses the importance of initial conditions in the systems. Thus the book provides the detailed explanation of modern approach of analysis which is the state variable analysis of the systems including methods of finding the state transition matrix, solution of state equation, and the concepts of controllability and observability. The book also introduces the concept of discrete time systems including digital and sample data systems, z-transform, difference equations, state space representation, pulse transfer functions, and stability of linear discrete time systems. The variety of solved examples is the feature of this book which helps to inculcate the knowledge of the design and analysis of the control systems in the students. The book explains the philosophy of the subject which makes the understanding of the concepts very clear and makes the subject more interesting.

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