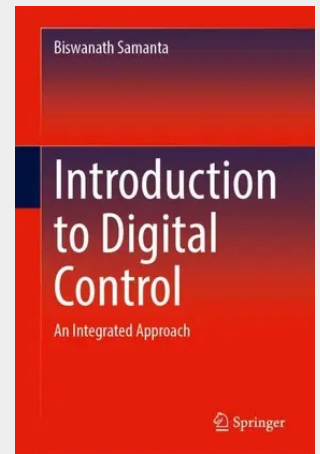


# Introduction to Digital Control

An Integrated Approach

This textbook presents an integrated approach to digital (discrete-time) control systems covering analysis, design, simulation, and real-time implementation through relevant hardware and software platforms. Topics related to discrete-time control systems include z-transform, inverse z-transform, sampling and reconstruction, open- and closed-loop system characteristics, steady-state accuracy for different system types and input functions, stability analysis in z-domain-Jury's test, bilinear transformation from z- to w-domain, stability analysis in w-domain- Routh-Hurwitz criterion, root locus techniques in z-domain, frequency domain analysis in w-domain, control system specifications in time- and frequency- domains, design of controllers – PI, PD, PID, phase-lag, phase-lead, phase-lag-lead using time- and frequency-domain specifications, state-space methods- controllability and observability, pole placement controllers, design of observers (estimators) - full-order prediction, reduced-order, and current observers, system identification, optimal control- linear quadratic regulator (LQR), linear quadratic Gaussian (LQG) estimator (Kalman filter), implementation of controllers, and laboratory experiments for validation of analysis and design techniques on real laboratory scale hardware modules. Both single-input single-output (SISO) and multi-input multi-output (MIMO) systems are covered. Software platform of Matlab/Simulink is used for analysis, design, and simulation and hardware/software platforms of National Instruments (NI)/LabVIEW are used for implementation and validation of analysis and design of digital control systems. Demonstrating the use of an integrated approach to cover interdisciplinary topics of digital control, emphasizing theoretical background, validation through analysis, simulation, and implementation in physical laboratory experiments, the book is ideal for students of engineering and applied science across in a range of concentrations.

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