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Slobodan N. Vukosavić

Digital Control of Electrical Drives

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Preface

This book is intended for engineering students in the final years of undergraduate studies. It is also recommended for graduate students and engineers aspiring to work in intelligent motion control and digital control of electrical drives. By providing a bridge between control theory and practical hardware aspects, programming issues, and application-specific problems, the book is intended to help the reader acquire practical skills and become updated regarding concrete problems in the field.

Basic engineering principles are used to derive the controller structure in an intuitive manner, so designs are easy to recall, repeat and extend. The book prepares the reader to understand the key elements of motion control systems; to analyze and design the structure of discrete-time speed and position controllers; to set adjustable feedback parameters according to design criteria; to identify, evaluate, and compare closed-loop performances; to design and implement nonlinear control actions; to devise and apply antiresonant compensators; and to generate speed reference profiles and position trajectories for use within motion-control systems. The Matlab tools are used extensively through various chapters to help the reader master the phases of design, tuning, simulation, and evaluation of speed and position controllers.

Key motion-control topics, such as nonlinear position control, control of mechanical structures with flexible couplings, compliance and mechanical resonance problems, and antiresonant solutions, are introduced in a systematic manner. A set of exercises, problems, design tasks, and computer simulations follows each chapter, enabling the reader to foresee the effects of various control solutions and actions on the overall behavior of motion-controlled systems. In addition to control issues, the book contains an extended introduction to the field of trajectory generation and profiling. In the closing chapters, the reader is given an overview of coding the control algorithms on a DSP platform. The algorithm coding examples are included, given in both assembly language and C, designed for fixed point DSP platforms. They offer a closer look into the characteristics and peformance of contemporary DSP cores and give the reader an overview of the present performance limits of digital motion controllers. Most of the control solutions presented in the book are supported by experimental evidence