Preface

In practice, most control systems are implemented on digital hardware. Typically, controllers designed in the continuous-time domain are individually converted to digital form at the end of the design phase using standard discretization techniques. This process, known as local digital redesign, is perfectly legitimate when the designer can implement the controllers with the sampling and update rates of his or her choice. Recall this simple rule of thumb: closed-loop stability is typically preserved with a discrete-time compensator obtained with a classical local digital redesign when the sampling rate is relatively fast. Furthermore, high-order discrete-time controllers provide satisfactory performance in case the computing capabilities available are sufficient. Yet, it may not always be possible to implement high-order controllers at fast update rates. Then, what design methods can be used to ensure closed-loop stability and satisfactory performance despite relatively slow update/sampling rates, and possibly a limited number of bits for control law operations? This topic has been studied by the authors for several years. This book offers a bridge between discrete-time control theory and practice by proposing techniques suitable for a real-time implementation at a relatively wide range of rates, and possibly a limited number of bits.

This book is aimed at academics, graduate students, industry researchers, and practitioners. The book provides a review of basic principles, followed by a presentation of the design techniques and the applications. The techniques are presented by way of sequential steps and algorithms. Although the book features two basic application examples, the techniques of discrete-time control system design apply to other dynamic systems.

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