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Book review:

Control Systems Theory with Engineering Applications

by

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The contemporary significance of the basic principles of Control Systems Theory have already far exceeded the scope of technical issues. It was perfectly natural that in the past these principles were developed by the exact thinking of engineers, and this was doubtless also fostered by the relative simplicity and considerable familiarity of their objects — objects which, after all, are the conscious creation of these same engineers. It is equally natural, however, that as progress was made these concepts could be transposed to more complex, less cognitively accessible issues in economics and management, sociology, even biology and medicine. Numerous publications have begun to appear on Control Systems Theory as applied to various and sundry fields of theory and practice; still, works on Control Engineering continue to dominate the field. In such case, however, authors are constrained to find specific aspects that differentiate their books from the considerable number of monographs already existing. The textbook Control Systems Theory with Engineering Applications by S.E. Lyshevski, published by Birkhuser in 2001, doubtless subscribes to this rule.

The book consists of five chapters, clearly divided into three parts with differing topics and manner of presentation.

The first three chapters serve as introduction and preliminaries. Of particular interest is the second chapter, which gives a series of instructive examples from the broad spectrum of issues that constitute the object of research in Control Engineering. The third chapter is subordinated to the rest of the book: it describes the basics of modeling using MATLAB.

The fourth chapter, primarily for educational use, contains an analysis of linear systems. The topics of discussion include PID controllers, many subproblems of the quadratic optimal control task using the Hamilton-Jacoby and Lyapunov Theories, and the pole placement design method. The majority of the tasks are considered for cases of continuous- and discrete-time, while many of the examples are supported by illustrative simulation programs contained on the CD-ROM disk attached to the book.

The fifth and final chapter is devoted to nonlinear systems. The object of consideration here is a range of various aspects of identification and control

Optimal control is dealt with in both the time-optimal and the quadratic performance index aspects. Robust control is also examined here, along with a particularly interesting treatment of sliding mode control with hard- and soft-switching structures. The continuous- and discrete-time cases are likewise discussed, with the support of illustrative simulation programs. The issues described in this chapter are already somewhat more scientific than educational.

It is difficult to arrive at a straightforward judgement on this book.

The degree of mathematical precision attained falls well short of the level of the theoretical material dealt with, or the complex subject matter. The text is not free of perplexities even on the level of notation and symbols. Though the work is intended to present the basics of Control Engineering, it does not provide a systematic review of the fundamental terms, or the most convenient methodologies for particular tasks.

On the other hand, a number of interesting examples are presented, covering the broad scope of electrical, mechanical and aerospace engineering, supported by simulation programs for purposes of illustration. The final sections contain many sophisticated methods proper to contemporary Control Engineering, described in a form enabling direct application. The book is written in a clear and comprehensible language. There is a distinct preference for the modern time domain approach, but when necessary this is supported by frequency methods.

To sum up: this book can certainly not be used as a basic, systematic textbook on Control Engineering. If, however, a graduate or undergraduate student, engineer, scholar, or scientist of practical bent prefers to expand his knowledge, on the basis not of theoretical reflections, but rather the results of illustrative simulation programs, then this book can serve as a very convenient guide. In this respect, Control Systems Theory with Engineering Applications by S.E. Lyshevski constitutes a valuable supplement to the whole variegated array of Control Engineering textbooks already published.

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S.E. Lyshevski: *Control Systems Theory with Engineering Applications*. Birkhäuser Verlag, Basel–Berlin–Boston, 432 pages, 2001. ISBN 0–8176–4203–X. Price: CHF 148.– (hardcover).