Lunze, Jan

Control theory. 1: System-theoretic foundations. Analysis and design of one-loop control. 3., erweit. u. bearb. Aufl. (Regelungstechnik. 1: Systemtheoretische Grundlagen, Analyse und Entwurf einschleifiger Regelungen.) (German) Zbl 0981.93001

Berlin: Springer (ISBN 3-540-42178-5). xxi, 603 S. (2001).

This is the third edition of an introductory German textbook on (linear) control theory for engineering students [for reviews of the first two editions see Zbl 0867.93002 (1st edition, Springer, Berlin, 1996) and Zbl 0940.93001 (2nd edition, Springer, Berlin, 1999)]. The general outline of the present third edition follows the first two editions; the main difference from the earlier versions lies in additional examples and exercises (especially biological control problems) and updates of the MATLAB examples.

After the introductory Chapter 1 and a description of various examples of control systems in Chapter 2, the first part of the book (Chapters 3-8) is concerned with the analysis of linear control systems. This part starts with a thorough introduction to state space models for linear control systems and their analysis in the time domain in Chapters 3-5, addressing in particular modeling issues, and the description and the analysis of linear systems. This part is accessible to anyone with a basic background in matrix calculus. Chapter 6 is devoted to the frequency domain behavior of linear control systems, where the application of the Fourier- and Laplace transforms to system analysis is described. The chapter also contains a well written short introduction to these transforms, however, for a complete understanding of the material some additional mathematical background knowledge may be helpful. In Chapter 7 closed loop systems are introduced, and Chapter 8 addresses the stability analysis (including robust stability) of closed loop systems.

The second part of the book (Chapters 9-13) is concerned with controller design techniques. It starts with an overview on one-loop control (with some more details on PID controllers) in Chapter 9. Chapters 10 and 11 are devoted to pole–zero based design and frequency response techniques, respectively, and in Chapters 12 and 13 several other techniques are discussed, including brief treatments of predictive and adaptive control.

One of the main features of the book is the use of MATLAB's control system toolbox. Whenever appropriate, the application of MATLAB to the theoretically discussed topics is illustrated at the end of the respective chapter. Furthermore, many exercises with MATLAB are given. An appendix contains a short introduction to MATLAB which should be sufficient to understand and to work with the examples in the book.

The book can certainly be recommended as a textbook for courses on linear control theory. Due to the detailed exposition with many illustrations, references and exercises (all solutions are given in the appendix), however, it is also very suitable for self-study.

Reviewer: Lars Gruene (Frankfurt)

MSC:

93-01	Introductory exposition (textbooks, tutorial papers, etc.) pertaining to systems and control theory	Cited in **2** Reviews
93B51	Design techniques (robust design, computer-aided design, etc.)	
93C05	Linear systems in control theory	
93D15	Stabilization of systems by feedback	
93A30	Mathematical modelling of systems (MSC2010)	

Keywords:

linear systems; time-domain; frequency-domain; stability; controller design; closed loop system; MATLAB; modeling

Software:

Matlab