Lunze, Jan

Automatization theory. Methods for supervisory control of continuous and discrete-event systems. (Automatisierungstechnik. Methoden für die Überwachung und Steuerung kontinuierlicher und ereignisdiskreter Systeme.) (German) ｜Zbl 1097.93001｜

München: Oldenbourg (ISBN 3-486-27430-9/hbk). xxiii, 607 S. (2003).

The book consisting of Preface, Contents, List of Applied Examples, Hint How to use the Book, 3 Parts (17 Chapters), References, 2 Appendices, and Index, introduces methods for supervision and control of continuous-time dynamic systems as well as discrete-event systems.

Part 1 (Introduction) surveys the basic goals and problems encountering in automation including several essential properties of dynamic systems.

Part 2 (Automatization of Continuous-Time Systems) deals mainly with the description and behaviour of LTI systems. Systems are considered only in the time-domain. Nonlinear systems are also mentioned. The concepts of controllability, observability, structural controllability, and structural obsrvability are introduced. Stability includes standard issues for stability of linear systems and the direct Lyapunov method for non-linear sytems. Basic requirements on the controller design, closed-loop systems properties, and controller types are presented. A complete PID controller design is described. The observer problem, Luenberger observer, and non-linear observer are introduced. The problem and the principle of model-based diagnosis are formulated. Then, fault detection using observers, sensor supervision, and fault identification are described.

Part 3 (Automatization of Discrete-Event Systems) starts with the description of their models using automata and Petri nets. Deterministic, non-deterministic, and stochastic automata are considered. Composite modelling of these systems is discussed. The behaviour of all these classes of discrete-event systems is characterized including their structural analysis. The concepts of control and control design are explained for automata and Petri nets. The observer problem is analyzed for all types of automata. The diagnosis problem considers non-deterministic and stochastic automata. Supervision and control of hybrid systems is briefly mentioned as an open future problem.

Appendix 1 contains solutions of exercises. Appendix 2 shows the main notions in English. The text is supplied with numerous applied examples and exercises.

The prerequisite for reading this book is some basic knowledge of matrix analysis, ODEs, graph theory, and set theory. This is the first textbook to give a comprehensive view of methods for supervision and control of continuous-time dynamic systems and discrete-event systems considering these systems as equal. The book is an extremely readable and practical text suitable for self-study. The textbook addresses undergraduate students of engineering and practitioners who wish to get a creditable introdution to the subject.

Reviewer: Lubomír Bakule (Praha)

MSC:

93-01	Introductory exposition (textbooks, tutorial papers, etc.) pertaining to systems and control theory
93Bxx	Controllability, observability, and system structure
93Cxx	Model systems in control theory
93C65	Discrete event control/observation systems
68Q85	Models and methods for concurrent and distributed computing (process algebras, bisimulation, transition nets, etc.)

Keywords:

supervision; control; continuous-time systems; discrete-event systems