Lecture Notes in Control and Information Sciences

Edited by M. Thoma and A. Wyner

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Singularly Perturbed and Weakly Coupled Linear Control Systems

A Recursive Approach

Springer-Verlag
Berlin Heidelberg New York
London Paris Tokyo Hong Kong

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ISBN 3-540-52333-2 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-52333-2 Springer-Verlag New York Berlin Heidelberg

Printing: Mercedes-Druck, Berlin
Binding: B. Helm, Berlin
2161/3020-543210 Printed on acid-free paper.

PREFACE

This book is designed to be a fairly comprehensive treatment of the recursive reduced-order methods for singularly perturbed and weakly coupled linear systems. There are numerous examples of singularly perturbed and weakly coupled dynamic systems that provide great challenges to engineers of different disciplines. Obvious examples of singularly perturbed and weakly coupled systems include electrical power systems, aerospace systems, large electric networks, process control systems in chemical and petroleum industries, etc. It is shown that the recursive reduced-order methods are applicable to wider classes of practical problems than the existing singularly perturbed and weakly coupled methods based on the power series expansion. The recursive methods offer several advantages. As it will be shown, the higher order of accuracy can be easily achieved at low cost, the parallel processing of information can be used, results are obtained under much milder assumptions (no analyticity requirements of the problem coefficients), the software and hardware implementation of the control algorithms is highly simplified due to complete parallelism in the design procedures.

This book is intended to the broad audience such as control engineers, applied mathematicians and advanced graduate students who seek a comprehensive view of the current developments in the theory of singularly perturbed and weakly coupled systems. The book emphasizes mathematical developments as well as their application to solving practical problems without assuming strong mathematical background of the readers.

To demonstrate the usefulness of the recursive reduced-order approach to the singularly perturbed and weakly coupled linear systems and to point out its various advantages we have included several real world examples: fluid catalytic cracker, twelve plate absorption column, magnetic type control system, F-8 aircraft, power system composed of two interconnected areas, distillation column, steam power system, and synchronous machine connected to an infinite bus.

We hope that this book will help to reduce some of barriers that exist in recognizing the power and usefulness of the recursive reduced-order methods for singularly perturbed and weakly coupled linear systems, and it will help to broaden their implementation in practice.

Z. Gajić is indebted to his former advisors, Professors H. Khalil and J. Medanić, and to Professor P. Kokotović for bringing him into the challenging research areas of singular perturbations and weak coupling.

Grant support from the following sources is gratefully acknowledged for Dj. Petkovski from the U. S. - Yugoslav Joint Fund for Scientific and Technological Cooperation, in cooperation with the National Science Foundation Grant JF 736, and in cooperation with the Department of Energy under grant JF 727. Dj. Petkovski is particularly thankful to Professor M. Athans and to Dr. A. Levis for fruitful cooperation in the course of these two projects.

The authors are thankful for the contributions of T. Grodt, Professor V. Kecman, N. Harkara, W-C Su, and Đ. Tasevski.

Novi Sad, July 1989. Authors

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