

SYSTEM THEORY
Modeling, Analysis
and Control

A Tribute to Sanjoy K. Mitter

Theodore E. Djaferis
Irvin C. Schick
(Editors)

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Edited by

Theodore E. Djaferis

University of Massachusetts Amherst

Irvin C. Schick

GTE Internetworking and Harvard University



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System Theory: Modeling, Analysis and Control

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IN ENGINEERING AND COMPUTER SCIENCE**

Preface

The word Symposium originates from the Greek word *συμπόσιον*. The literal meaning of the word is “to drink together.” In ancient Greece the word was used to describe a gathering where not only drinking and eating took place but intellectual discussions as well. It is precisely for this reason that the writings of a number of notable philosophers, including Plato, bare the title: *συμπόσια*. There is a perfect characterization of the Symposium Advances in System Theory, an event organized to celebrate Sanjoy K. Mitter’s 65th birthday. The timing of the Symposium comes at the end of a fifty year period during which the field of Systems and Control Theory has experienced dramatic growth. The contents of this book on the one hand reflect on past research accomplishments and on the other provide insight on future research directions.

The book *System Theory: Modeling, Analysis and Control* is a collection of papers contributed to this Symposium. There are thirty three scientific papers included in the book that fall in the following technical areas: Distributed Parameter Systems, Stochastic Control, Filtering and Estimation, Optimization and Optimal Control, Image Processing and Vision, Hierarchical Systems and Hybrid Control, Nonlinear Systems, and Linear Systems. These papers are very representative of past and current research activity in systems and control. They include three survey papers on Optimization, Nonlinear Filtering and Nonlinear Systems. Recent advances are reported on the behavioral approach to systems, the relationship between differential games and robust control, estimation of diffusion processes, Markov processes, optimal control, hybrid control, spectral estimation, nonconvex quadratic programming, robust control, control algorithms and quantized linear systems. Innovative explorations are described on quantum systems from a control theory perspective, option valuation and hedging, three-dimensional medical visualization, computational structure biology, image processing, hierarchical approaches to complex systems, flow control, scheduling, and force feedback in fluid mechanics. The unifying thread that ties all these papers together is the use of mathematics for developing a keener understanding of physical phenomena and man made

systems. These new tools have allowed researchers to gain more insight into the dynamic operation of these systems and to suggest methods for automatic control. Ultimately, this knowledge leads to increased productivity, promotes economic development and has a positive impact on our quality of life.

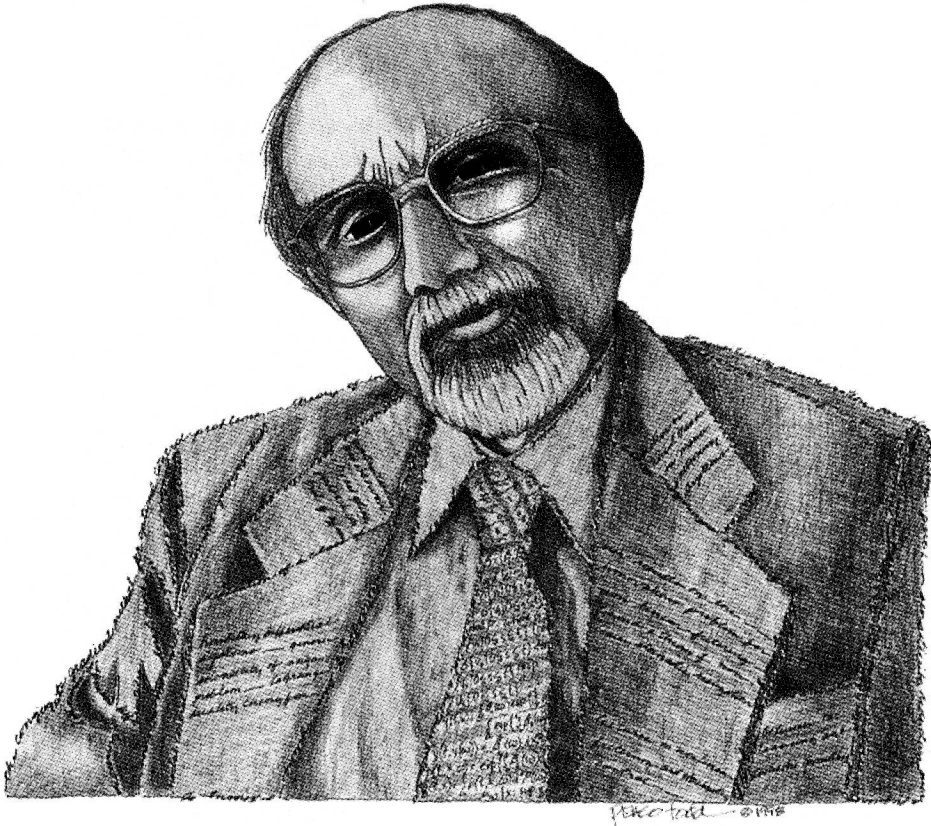
First and foremost, I would like to thank Sanjoy K. Mitter for his guidance and support. This book is dedicated to him! I am particularly grateful to all contributing authors for their timely response to our call. Without their hard work this event would not have been possible. Planning for the Symposium has been very rewarding as it gave me the opportunity to revive old friendships and make new ones. The experience also gave me a renewed appreciation of the intricacies of electronic publishing. Even though we have come far from the days of the typewriter the advances are not without cost (i.e., “No Free Lunch Theorem.”)

I would like to express my sincere thanks to the Army Research Office and Dr. Linda Bushnell in particular, and to the National Science Foundation and Dr. Kishan Baheti, for providing financial support for the Symposium. The views, opinions, and/or findings contained in these papers are those of the authors and should not be construed as an official Department of the Army (or NSF) position, policy, or decision, unless so designated by other documentation. Support has also been provided by the Electrical and Computer Engineering Department at the University of Massachusetts Amherst, Professor Seshu Desu Department Head, and the Massachusetts Institute of Technology.

Special thanks go to Irvin Schick, my co-editor, for his assistance in all aspects of this event. Technical assistance with Latex was provided by Pam Williams, Vishal Misra and Steve Morin. Pat Zuzgo has assisted with finances and registration and Kathleen O’Sullivan with publicity. Their help is greatly appreciated.

THEODORE E. DJAFERIS

*It is with great respect and admiration
that we dedicate this volume to a
magnificent friend, scholar, teacher and mentor*



Sanjoy K. Mitter

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