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CIP

THIS VOLUME IS DEDICATED

TO :

PROFESSOR FAZLOLLAH REZA

FOR

**FIFTY YEARS OF CONTRIBUTIONS TO CIRCUIT AND NETWORK
THEORIES, CONTROL SYSTEMS, SYSTEM THEORY, INFORMATION
THEORY, CYBERNETICS, APPLIED MATHEMATICS,
AND
PERSIAN POETRY AND LITERATURE.**

THIS WORK IS DEDICATED

PROFESSOR FAZLOLLAH REZA

AND

THESE YEARS OF SERVICE TO SCIENCE AND RESEARCH
AND THE CONTRIBUTION TO THE SCIENTIFIC INFORMATION
THEORY, ENGINEERING AND APPLIED MATHEMATICS

AND

FAZLOLLAH REZA

Fazlollah Reza, a prominent scientist, engineer and Persian literary personality, received his B.S. degree in engineering from University of Tehran in 1940, M.S. from Columbia University, in 1946 and Doctor of Electrical Engineering from the Polytechnic Institute of New York in 1950. He has served as a member of faculty of MIT and Syracuse University. He has been guest professor at ETH (Zürich), Royal Technical University (Copenhagen), University of Colorado (Boulder), University of Paris, and Carleton University (Ottawa). He has numerous publications including the first book on information theory published by McGraw Hall in 1961. His administrative posts include the Chancellorships of University of Tehran, Tehran University of Technology, Ambassador of Iran to UNESCO (1969-1974) and to Canada (1974-1978). He is currently an honorary professor at McGill University and visiting professor at Concordia University in Montreal.

PREFACE

Robotics and Manufacturing remain as two highly interdisciplinary and critical technological areas for the future economic, social and even political well-being of many nations around the globe. Automated manufacturing with or without robots stands to be of immense critical value in fast-emerging peaceful world around us.

The object of this volume is to report on the technical presentations of ISRAM '90 — The Third International Symposium on Robotics and Manufacturing, held July 18-20, 1990 in Burnaby, B.C., Canada. ISRAM, which began in 1986 in Albuquerque, New Mexico, USA, is considered as a relatively small, highly interactive, and international gathering of robotics and manufacturing engineers, educators, researchers, and administrators. This most recent ISRAM was attended by over 200 individuals with some 160 papers and 7 keynote speeches delivered. The distinguished group of keynote speakers and their presentations were:

1. Dr. Nick Cercone, Director Centre for System Science on "The CSS Research Interstructure; One Example is Human Interface"
2. Dr. Melvin Cohen, Vice President AT&T Bell Laboratories on "Time as a Competitive Tool for Product Realization"
3. Dr. John M. Hollerbach, NSERC Professor of McGill University on "Robotics Research in Canada and at McGill"
4. Mr. Ronald McCollough, Vice President SPAR Aerospace on "Advances in Robotics in Hazardous Environments - How Space Drives the Way"
5. Mr. Mick Kahan, Director of CIM Integration Systems, IBM-Canada, Ltd. on "Manufacturing Excellence in the 90's"
6. Dr. Margarette Eastwood, Director of Factory Automation, Motorola Corporation on "U.S. Electronic Manufacturing Technology"
7. Dr. Lotfi A. Zadeh, Professor, University of California - Berkeley on "Fuzzy Logic and Control"

The presentations of the technical papers of ISRAM '90 in this volume have been similar to other ISRAMs and have been grouped in accordance to specialized areas of robotics and manufacturing for easy access of the readers. In order to access the technical papers based on the location or the author, the subject and author indices at the end of the volume can be consulted as well.

The editors would like to take this opportunity to thank every one of the keynote speakers and authors for their contributions to robotics and manufacturing in general, and to this volume in particular. We wish to express our gratitude to the program and organizing team members of ISRAM '90. Numerous colleagues have gracefully taken interest in this meeting and have put a great deal of effort in organizing sessions. We would like to thank: M. Beckerman, D. Bosomworth, R.L. Carroll, C.H. Dagli, P. Dauchez, A. Goldenberg, W. Hamel, S. Hayati, J.N. Herndon, R.M. Inigo, D.C. Krupka, R. Lumia, S.J. Mendonca, J.H. Mullins, C.C. Nguyen, S. Ollendorf, T. Salcudean, H. Seraji, A. Steiger-Garcia, J. Vozenilek, C.R. Weisbin and J. Yuh. Without their efforts, the Symposium's technical content would not have been the same. Thanks are also due to all the Chairs and Co-chairs of the sessions.

We would like to express our appreciation to several members of Simon Fraser University and the University of New Mexico's administrations. Foremost, we appreciate the financial sponsorships of a number of Canadian institutions including: Simon Fraser University's School of Engineering Science, SFU's Centre for System Science, Natural Science, Research Council of Canada (NSERC), and Advanced Systems Institute of British Columbia. We thank President W. Saywell, Dr. Marilyn Bowman, VP for Research and Information Systems, SFU, Dean Donald George, and Professor Nick Cercone of SFU for their valuable help and encouragement. We thank Dean James E. Thompson of UNM's College of Engineering for his continuous support. We appreciate encouragements of Professor Nasir Ahmed, Chair of EECE Department at UNM. We sincerely thank the fine efforts of Professors Andy Goldenberg (Toronto), Rajini Patel (Concordia), Joe Mullins (UNM), Dr. Doug Bosomworth (Motorola) and Dr. Steve Mendonca (IBM) for playing major roles in inviting and arranging for the participation of our keynote speakers.

We wish to express our most sincere gratitude to Mrs. Janet Watts of UNM's CAD Laboratory for Systems/Robotics for her tireless assistance to the editors. Our task was made very simple thanks to her dedicated upkeep of the affairs of yet another Symposium. We appreciate the valuable and dedicated editorial assistance of Mrs. Janet S. Jafari and Mrs. Jila S. Jamshidi for organizing the two indices and much much more. We appreciate the collaborations of Ms. Caryl Dreiblatt and Dr. Ken Metzner of ASME Press and their staff during the printing of this volume.

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