

# Preface

For centuries it has been the desire of human beings to find better and better materials to achieve a variety of benefits for the mankind. This has been in vogue from the stone-age. The recent revolution discovering Smart Materials and Functionally Graded Materials is one of those attempts. These materials are inherently multi functional and they opened up possibilities which could not be imagined in the past. Materials can take a particular type of energy stimulus as input and generate an output belonging to a different type of energy. Typical example has been materials on which a mechanical force can produce electrical output. We are in twentyfirst century where in materials Research will totally concentrate on these new concepts and exploit them for variety of applications. Structural Health Monitoring leading to safety of operations is the primary application the aerospace, mechanical, nuclear and civil engineers will be expecting from this research. The Micro- and Nano-scale sensors and actuators form the basis for this technology and Departments of Science and Technology in all the countries are investing heavily on this highly potential field.

In India, the scientific group in this area is active for the past decade. They formed in 1999 a professional society named as Institute of Smart Structures & Systems (ISSS) which has been holding National and International seminars and also helping the government departments to fund research and development of relevance to this novel materials and structures. National Program on Smart Materials (NPSM) and the second phase program NPMASS are the consequences of these efforts. The current symposium is part of this effort and the Editors of this publication are also scientists involved in these developments.

This symposium covered novel theories, mathematical models, analyses, manufacturing methods and application of computational and experimental methods. This publication is thematically divided into seven sections with a total of 35 papers authored by International Scientific Community. The coverage is quite comprehensive and it is heartening that half of these papers are from R&D in Indian organizations. We trust this volume will provide to researchers and applied technologists on the potential fruitful directions.

The Editors express their sincere thanks to International Union of Theoretical and Applied Mechanics (IUTAM) for sponsoring this symposium on “Multi-Functional Materials Structures & Systems” (IUTAM-MMSS08) at the Indian Institute of

Science (IISc), Bengaluru during 2008. The application was processed through Indian National Science Academy (INSA) and Prof. N.K. Gupta, one of the Vice-Presidents of INSA encouraged us to bid for it. Thanks to INSA and Prof. Gupta. The symposium was held between 10–12 December, 2008 at the Satish Dhawan Auditorium, IISc. Eightyfive delegates attended the symposium (with 22 of them coming from outside India) and the presentations brought out the core expertise available around the world in this newly emerging field. This book is the proceedings of this symposium. The papers were reviewed by International experts in this field and were revised before accepting for publication. Special thanks to all the reviewers who spent considerable amount of time on the papers in spite of their busy schedule.

From the time the symposium was approved by IUTAM, Prof. D.H. van Campen, Secretary General and Prof. J. Engelbrecht, Treasurer have been in constant touch with us and we were sending updates to them continuously. They were always prompt in replying to our enquiries. IUTAM provided funds to enable the organizers to support some of the participants towards Registration fee and accommodation and transport at Bengaluru. There was a change in Office bearers of IUTAM at the end of the year 2008. Prof. Frederic Dias and Prof. Niels Olhoff, who are the Secretary General and Treasurer of the new committee, helped us to finalize the accounts and closure report to IUTAM. Thanks to all Office Bearers of IUTAM.

We have also received generous financial support from Aeronautics R&D Board (ARDB), Government of India; Institute of Smart Structures & Systems (ISSS) and the Indian Institute of Science. We would like to express thanks to all of them.

The Assigned Scientific Committee consisted of experts in the area from around the world. Prof. J. Dual from Switzerland was the IUTAM representative. Many of the Committee members presented papers at the symposium. Their acceptance to be on the committee has been a great inspiration and we thank them all for their help and suggestions from time to time. The International Steering Committee chaired by Dr. V.K. Aatre, one of the Editors of this volume, was deeply supportive for the conduct of the symposium. One of the members from outside India, Dr. F.G. Buchholz of the University of Paderborn, Germany attended the symposium and chaired two sessions.

Prof. B.N. Raghunandan, Chairman, Department of Aerospace Engineering and Prof. P.J. Paul, Convener, Joint Advanced Technology Program at IISc and some of our senior colleagues including Profs. C.R.L. Murthy, Ranjan Ganguli, Kartik Venkataraman extended their full support for the symposium and thanks are due to all of them. Research and Masters' students helped us in many ways and thanks to all of them for their help. Mr. Shivanand Bhavikatti helped us in organizing the manuscript of the proceedings and this is acknowledged with thanks.

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