

Preface

On November 20-22, 2003, 60 Japanese and American engineers from industry, academia, government labs, and other research institutions gathered for the Third Japan-America Frontiers of Engineering Symposium (JAFOE) in Irvine, California. Convened by the U.S. National Academy of Engineering (NAE), the Japan Science and Technology Agency (JST), and the Engineering Academy of Japan (EAJ), this exciting and unique meeting included presentations and discussion of leading-edge research and technical work in four sessions: Large-scale Civil Systems, Electrifying the 21st Century, Systems Biology and the Emerging Discipline of Biological Engineering, and Multimedia Networking. The primary purpose of this book is to convey the content of the meeting through abstracts of the presentations and other meeting materials reprinted herein, as well as to inform the reader about the underpinning philosophy of the Frontiers of Engineering program.

Origins and Goals of the Activity

Since 1995, the U.S. National Academy of Engineering has held an annual U.S. Frontiers of Engineering symposium that brings together 100 outstanding, early-career engineers from U.S. companies, universities, and government labs to discuss pioneering research and technical work across a range of engineering fields. The goal of the symposium series is to introduce these engineers to each other, challenge them to think about developments and problems at the frontiers of areas different from their own, and thereby facilitate collaborative work, the transfer of new techniques and approaches across fields, and establishment of contacts among the next generation of engineering leaders. The program expanded internationally with the inauguration of the German-American Frontiers of Engineering meetings in 1998. A second bilateral Frontiers program, the Japan-America Frontiers of Engineering Symposium, was started in 2000.

The JAFOE activity aims to bring together outstanding, early-career Japanese and American engineers (ages 30-45) from industry, universities, and other research institutions to introduce their areas of engineering research and technical work, thereby facilitating an interdisciplinary transfer of knowledge and methodology that could eventually lead to the development of cooperative networks of young engineers from both countries. Conferences are held annually, alternately in Japan and the United States, with about 30 engineers from each country participating. An organizing committee comprised of Japanese and U.S. engineers develops the program for the event and assists in the selection of participants.

Content of the 2003 JAFOE Symposium

Dr. James Fujimoto, professor, Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, and Dr. Kazuhiro Sakurada,

principal investigator, Department of Frontiers Medicine, Tokyo Research Laboratories, Kyowa Hakko Kogyo Co., Ltd., co-chaired the organizing committee and the symposium. Two Japanese and two Americans gave presentations in each of the four sessions mentioned above. Presentations covered such specific topics as strategic maintenance of bridges of the Tokaido Shinkansen, the evolution of competitive power markets, proteomic analysis of cellular signaling, and video compression and streaming. Speakers had been asked to tailor their talks to a technically sophisticated but nonspecialist audience and to address such questions as: What are the frontiers in their field? What experiments, prototypes, and design studies are completed and in progress? What new tools and methodologies are being used? What are the current limitations on advances: What is the theoretical, commercial, societal, and long-term significance of the work?

In addition to excellent presentations in the four topic areas, another highlight of the symposium was the dinner speech by Dr. Robert Conn, managing director of Enterprise Partners Venture Capital in La Jolla, California. Dr. Conn described how his career as an engineer had evolved through positions in academia and industry, and he concluded with an insightful perspective on the U.S. venture capital industry. The text of his talk is included in this volume.

The meeting was designed to give ample opportunity for discussion and networking among the participants through Q&A time after each presentation in the plenary sessions as well as poster sessions that allowed each participant to showcase and talk about his/her technical work or research. In addition, the group took a tour of the Jet Propulsion Lab at the California Institute of Technology in Pasadena and were privileged to hear about the Mars Exploration Rover mission launched in January 2004 from the project manager, Pete Theisinger. This was followed by dinner at The Athenaeum, the faculty club at Caltech. With a view to possibly expanding this meeting to include engineers from other Pacific Rim countries at some time in the future, two early-career engineers from China and the Foreign Secretary of the National Academy of Engineering of Korea attended JAFOE as well.

A fourth Japan-America Frontiers of Engineering symposium will be held in November 2004 in Japan, and planning for that meeting is underway.

In Appreciation

We would like to express our appreciation to our sponsors – the Japan Science and Technology Agency, the U.S. Air Force, the U.S. Office of Naval Research International Field Office, and the National Academy of Engineering Fund – for their support of this symposium. We also would like to thank the members of the Symposium Organizing Committee for their work in planning this event.

Note: The content of the information does not necessarily reflect the position or the policy of the United States Government and no official endorsement should be inferred.