

Preface

On November 9-11, 2006, 60 Japanese and American engineers from industry, academia, government labs, and other research institutions gathered for the Sixth Japan-America Frontiers of Engineering Symposium (JAFOE) at Tsukuba International Congress Center in Tsukuba, Japan. Convened by the U.S. National Academy of Engineering (NAE), Japan Science and Technology Agency (JST), and the Engineering Academy of Japan (EAJ), this exciting and unique meeting included presentations and discussions of leading-edge research and technical work in four sessions: Cybersecurity, Biomechanics, Systems and Synthetic Biology, and Organic Electronics. 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 engineers (ages 30-45) from U.S. companies, universities, and government to discuss leading-edge research and technical work across a range of engineering fields. The goal of the 2-1/2-day symposium 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 leaders in engineering. The program has expanded internationally, and there are now three bilateral programs — with Germany, Japan, and India.

The JAFOE activity aims to bring together outstanding, early-career Japanese and American engineers 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 2006 JAFOE Symposium

Dr. Glenn Fredrickson, professor of materials and chemical engineering and director of the Mitsubishi Chemical Center for Advanced Materials at the University of California, Santa Barbara, and Dr. Kazuhiro Sakurada, executive officer and head of , Research Center Japan, Nihon Schering K.K., 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 recent advances in self-directed network intrusion detection, microfabrication and scaling of biomedical devices, membrane protein chips, and new materials and processing opportunities for organic electronics and optoelectronics. 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. Yasunori Furukawa, president and CEO of Oxide Corporation. Dr. Furukawa gave an entrepreneur's perspective on the growth path of Oxide Corp., the first spin-off venture company from the National Institute for Materials Science. The content of his talk is included in this volume.

The meeting was designed to give ample opportunity for discussion and networking among the participants through the Q&A sessions 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, something new was incorporated into the program: participants were divided into five groups where they discussed policy topics and developed messages to society. The conclusions are included in this volume as the "Messages to Society." The participants also took a tour of the Tsukuba Space Center (JAXA), Science Square Tsukuba (AIST) and Geological Museum (AIST).

The seventh Japan-America Frontiers of Engineering symposium is scheduled for November 5-7, 2007, in Palo Alto, California.

In Appreciation

We would like to express our appreciation to our sponsors —the Japan Science and Technology Agency; the U.S. National Science Foundation, and the National Academy of Engineering Fund — for their support of this symposium. Our appreciation also goes to the members of the Symposium Organizing Committee for their work in planning this event.