

Report

Second Japan-America Frontiers of Engineering Symposium (Tokyo: 24-26 Oct. 2002)

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Nov. 8, 2002

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Keywords

Bioengineering, Bio-medical engineering, nanomaterials, nanotechnology, manufacturing, decision analysis, computer science, information technology.

Summary and assessment

The Second Japan-America Frontiers of Engineering Symposium was held on 24-26 October 2002 in Tokyo. This meeting brought together a small group of invited researchers representing a wide spectrum of engineering fields and research approaches. Through poster sessions and presentations, each participant described their recent work and developments and challenges in their areas. In this manner, new ways of thinking and new opportunities for cross-disciplinary collaboration were encouraged.

There were four technical sessions:

- Bioengineering
- Synthesis and applications of nanomaterials
- Sustainable manufacturing
- Pervasive computing

The Symposium was sponsored by several organizations among which was the Office of Naval Research. I was a member of the organizing committee, and was responsible for the *Sustainable Manufacturing* session (with Prof. K. Aoyama of the University of Tokyo).

I found the Second Japan-America Frontiers of Engineering Symposium a stimulating and intellectually refreshing experience. I believe that it contributed in an effective way to fostering productive international technical relationships and, potentially, collaborations.

Purpose and format of the symposium

Since 1995, the National Academy of Engineering has held an annual three-day Frontiers of Engineering symposium that brings together 100 leading engineers (ages 30-45) from U.S. companies, universities, and government labs to discuss leading-edge research and technical work across a range of engineering fields. Convening engineers from disparate fields and challenging them to think about developments and problems at the frontiers of areas different from their own will, it is believed, lead to a variety of desirable results. These include intellectual cross-pollination, stimulation of creative, “out of the box” conceptualization, and establishment of contacts among the next generation of leaders in engineering.

In 1998 the first bilateral Frontiers symposium was held, with American and German participation. The idea for a bilateral Frontiers of Engineering with Japan was first discussed with the Engineering Academy of Japan in 1997. After several Japanese engineers attended the 1998 U.S. Frontiers of Engineering symposium as observers, it was decided that initially two conferences would be held, the first in 2000, and a subsequent one in 2001 or 2002.

To facilitate interactions, the total number of participants in the Japan-America Frontiers of Engineering symposiums (JAFOE) is limited to a total of 60 including the organizing committee. Participants are 30-45 years old (including organizers). The first JAFOE symposium was held 2-4 November 2000 in Nara, Japan and I was an invited participant.¹ The second, the subject of this report, was held 24-26 October 2002 in Tokyo. I was a member of the organizing committee.

The Second Japan-America Frontiers of Engineering Symposium was put together by the National Academy of Engineering, the Engineering Academy of Japan, and the Japan Science and Technology Corporation. It was supported by grants from the Japan Science and Technology Corporation, the Office of Naval Research, the Army Research Office, and the National Science Foundation.

¹ Koenig, P. C. *Report: First Japan-America Frontiers of Engineering Symposium*. (Tokyo: ONR IFO, 12 Jan 2001.)

Technical program

Four sessions were held. As cross-disciplinary sharing was a primary objective, every presentation was plenary. In addition to the paper sessions, there was a poster session in which all participants presented. (*An unusual conference: number of presenters = number of attendees.*)

For my poster session, I provided an introduction to ONR IFO, NICOP, etc. This was not technical material but I felt it would be useful.

The sessions were:

1. Bioengineering

Organizers: Linda Griffith (MIT) and Kazuhiro Sakurada (Kyowa Hakko Kogyo Co., Ltd.)

- 'Molecular engineering of gene and stem cell therapeutics'
David Schaffer (University of California, Berkeley)
- 'Tissue engineering based on technology of growth factor release'
Yasuhiko Tabata (Kyoto University)
- 'The use of chromosome-based vectors for animal transgenesis'
Kazuma Tomizuka (Kirin Brewery Co., Ltd.)
- 'Ethical issues in genetic research'
Lainie Friedman Ross (University of Chicago)

2. Synthesis and applications of nanomaterials

Organizers: Jackie Ying (MIT) and Itaru Kamiya (Mitsubishi Chemical Corporation.)

- 'Advanced nano-carbon materials'
Kazu Suenaga (National Institute of Advanced Industrial Science and Technology, Japan)
- 'Electrical conductance of nanofilms, nanowires, and point contacts'
Tomonobu Nakayama (National Institute of Material Science, Japan.)
- 'Designing porous structures by colloidal crystal templating – Materials for photonics and beyond'
Andreas Stein (University of Minnesota)

3. Sustainable manufacturing

Organizers: Philip Koenig (ONR IFO) and Kazuhiro Aoyama (University of Tokyo)

- 'Innovative information infrastructure for manufacturing and product development'
Hiroyuki Sawada (National Institute of Advanced Industrial Science and Technology, Japan)
- 'Rational decision methods for investing in modern manufacturing technologies'
Mark Spicknall (University of Michigan)
- 'Design for the environment and recycling'
David Rosen (Georgia Institute of Technology)
- 'Eco-design and inverse manufacturing'
Hideki Kobayashi (Toshiba Corporation)

4. Pervasive computing

Organizers: Charles Peck (IBM T. J. Watson Research Center) and Yasuhito Hayashi (NTT Corp.)

- 'Interacting with a computer augmented environment'
Jun Rekimoto (Sony Computer Science Laboratories Inc.)
- 'Applications research in ubiquitous computing'
Gregory Abowd (Georgia Institute of Technology)

‘Interface agent for ubiquitous computing environment’

Kenji Mase (Nagoya University)

‘Personal servers: Pushing the limits of personal computing’

Roy Want (Intel Corporation)

Researchers citing ONR support

Two of the presenters acknowledged ONR support:

- David V. Schaffer
Assistant Professor of Chemical Engineering
University of California, Berkeley
- Andreas Stein
Associate Professor, Department of Chemistry
University of Minnesota

In my view, these were two of the most stimulating presentations of the Symposium.

Session on *Sustainable Manufacturing*

The session on Sustainable Manufacturing was put together by Prof. Kazuhiro Aoyama (University of Tokyo) and me. Our session abstract summarizes the theme of the session and of the presentations:

Some important socio-technical issues revolve around the sustainability of classic manufacturing industries in developed countries; sustainability from the standpoints of (1) industrial competitiveness and (2) environmental preservation. These two types of sustainability are old problems but they are critical to the needs of society and both remain unsolved. Can new technologies and new approaches to the management of technology eventually provide solutions?

Sustaining manufacturing competitiveness

It is not clear if manufacturing is ultimately sustainable in high cost, developed nations. Some manufacturing industries, for instance cotton textiles, have historically migrated to a succession of developing countries in a presumably endless search for the lowest factor costs. Other manufacturing sectors, such as the automobile industry, have remained pretty firmly centered in North America, Western Europe, and Japan despite determined challenges from outside. Why have some industries been able to sustain their competitiveness in advanced economies, while others cannot? There are many factors that play into this but it does appear that sustainable manufacturing industries manage to implement carefully selected new technologies in order to lower costs and/or improve product. Dr. Sawada and Mr. Spicknall will present some ideas on how this key function is carried out.

Environmental sustainability

Environmental sustainability is a big problem in manufacturing. Manufacturing industries impact the natural environment most clearly when smokestacks belch atmospheric pollutants, when noxious wastes are carelessly disposed of, and so on. However, there are many other dimensions to the problem. For example, there is a need to design and build environmentally conscious operational attributes into products as well as

processes. Scrapping and recycling is another issue that affects design, manufacturing, and 'de-manufacturing' approaches and technologies. Furthermore, regardless of which part of the product cycle attention is focused, the identification (and costing) of environmental impacts can be a problem. Dr. Kobayashi and Dr. Rosen will discuss some of the key technological issues involved in environmentally sustainable manufacturing.

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