

Sixth IFAC Symposium on Mechatronic Systems (MECH 2013)

The Sixth IFAC Symposium on Mechatronic Systems (MECH 2013) (<http://sklofp.zju.edu.cn/ifac2013/>) was held on April 10–12, 2013 in Hangzhou, China. The technical sponsor of the symposium was the IFAC Technical Committee on Mechatronic Systems (TC 4.2) with the support of the ASME DSCD Mechatronics Technical Committee, the National Natural Science Foundation of China (NSFC), the Ministry of Education of China, the Chinese Mechanical Engineering Society, and the Chinese Association of Automation. The symposium was hosted by the Institute of Mechatronic Control Engineering of Zhejiang University, which has the only state key laboratory on mechatronic systems in China, the State Key Laboratory of Fluid Power Transmission and Control. This was the first time that this symposium was held in Asia.

The purpose of the symposium, following in the footsteps of the previous five (2000 in Darmstadt, Germany; 2002 in Berkeley, California, United States; 2004 in Sydney, Australia; 2006 in Heidelberg, Germany; and 2010 in Boston, Massachusetts, United States), is to promote activities in various areas of mechatronics by providing a forum for the exchange of ideas, presentation of technical achievements, and discussion of future directions.

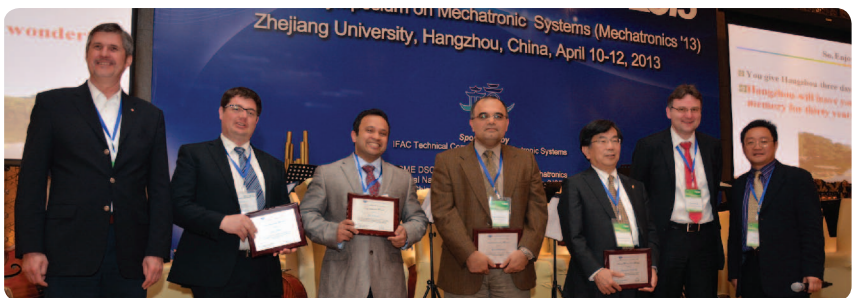
There is a strong overlap between the focus of the symposium and that of the Eighth International Conference on Fluid Power Transmission and Control (ICFP 2013) (<http://sklofp.zju.edu.cn/icfp2013>), which sparked the idea of



Opening remarks by Honorary Chairs Yongxiang Lu and Masayoshi Tomizuka.

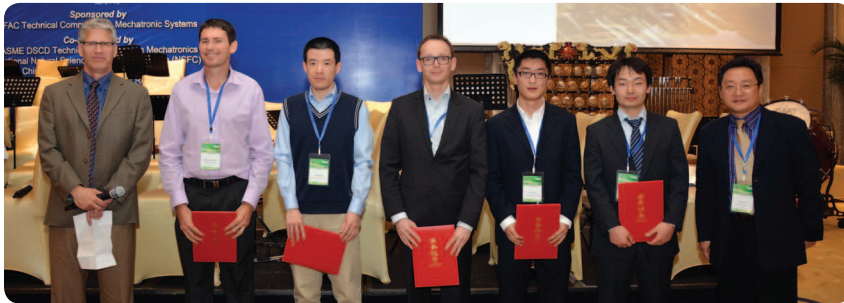


Panelists of the forum “Future Education on Mechatronics.”



Recipients and Award Committee chairs of the IFAC Technical Committee on Mechatronic Systems.

concurrently holding the two events at the same location. The organizing committees of the two events worked out schemes to maximize the participants’ experience from technical, social, and financial aspects. Participants freely



(From left) Award Committee Chair Brad Paden; Best Student Paper Award Finalists Matthew Fairbairn, Cong Wang, Tomas Tuma, Junkai Lu, and Shingo Ito; and IPC Chair Bin Yao.



The IFAC Technical Committee on Mechatronic Systems meeting, chaired by Reza Moheimani.

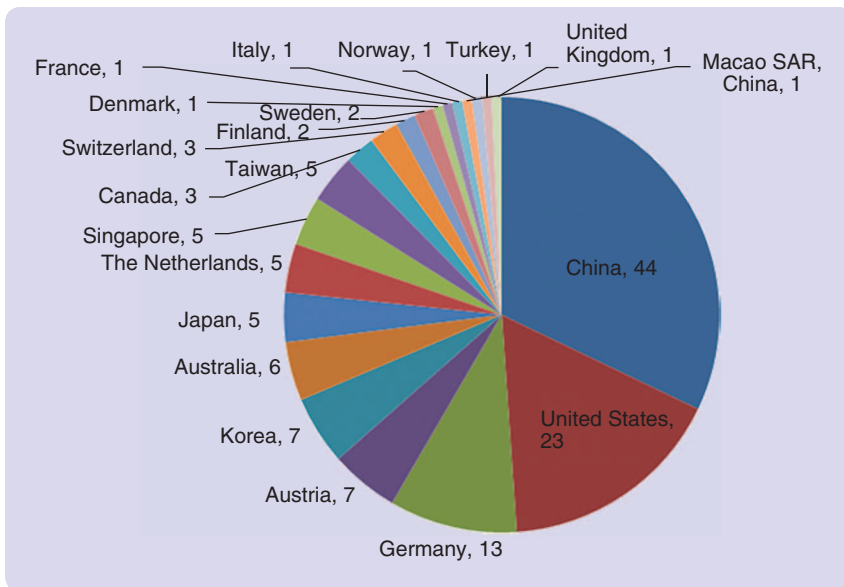


FIGURE 1 The number of participants for IFAC MECH 2013 by country/region.

selected the sessions from the two events that they wished to attend, regardless of the event for which they registered.

SYMPOSIUM SCOPE

The symposium brought together an international community of experts to discuss the state of the art, new

research results, perspectives of future developments, and innovative applications relevant to mechatronics, robotics, control, automation, and related areas. Topics included actuators; automotive systems; electronic packaging; fault diagnosis; human-machine interfaces; industrial applications; informa-

tion technology; intelligent systems; machine vision; micro-electro-mechanical systems (MEMS); micro/nano technology; motion, vibration, and noise controls; optimal, adaptive, neural, and fuzzy controls; optoelectronic systems; real-time and hardware-in-the-loop simulation; robotics; system integration; transportation systems; and other control applications.

SYMPOSIUM PROGRAM AND DELEGATES

An International Program Committee (IPC) of 34 members from 16 countries/regions was responsible for the symposium's technical program. A total of 302 registrants participated in the two events, with 165 for ICFP 2013 and 137 for MECH 2013. The 137 were from 21 countries/regions as described in more detail in Figure 1. The host institution, the Institute of Mechatronic Control Engineering of Zhejiang University, also mobilized its graduate students (more than 300) to attend relevant sessions, conduct lab tours and experimental demonstrations, and help with the organization of the two events.

The technical program included a panel forum, Future Education on Mechatronics, and three plenary and four semiplenary lectures representing North America (Prof. Brad E. Paden and Prof. Tsu-Chin Tsao), Europe (Prof. Klaus Janschek and Prof. Andreas Kugi), and Asia (Prof. Makoto Kaneko, Prof. Han Ding, and Prof. Reza Moheimani). The program had 18 technical sessions comprising 98 papers selected from 117 full paper submissions from 20 countries/regions, with 26 papers from the host country of China. A detailed program of the symposium and the proceedings are open access at the IFAC PapersOnline Electronic Library (http://www.ifac-papersonline.net/Mechatronic_Systems/6th_IFAC_Symposium_on_Mechatronic_Systems_2013/index.html) and are indexed by Scopus and EI.

HIGHLIGHTS OF SESSIONS

The three plenary and four semiplenary lectures were delivered by well-known

researchers in the field. Prof. Brad E. Paden of the University of California at Santa Barbara and LaunchPoint Technologies, Inc., United States, gave the opening plenary lecture, "Adventures in Mechatronics." Prof. Paden drew on his past research to illustrate the creativity, challenge, technical depth, and professional enjoyment associated with the invention and design of mechatronic devices. Example systems included maglev transportation, a guided catheter, an oxygen concentrator, maglev artificial hearts, high-speed switching mechanisms including an electronic engine valve, energy storage, a MEMS device, and a high-energy battery.

Prof. Klaus Janschek of Technische Universität, Dresden, Germany, delivered the second plenary lecture, "Trapping and Guiding the Light—A Systems View on Optomechanics." His talk showed that combining optomechanical and optoelectronic engineering under the umbrella of the systems-oriented mechatronics engineering paradigm offered more added value than either the pure sum of heterogeneous technologies synthesized in one technical product or just integrating optical technology into the mechatronic loop.

In the third plenary lecture, "Hyper Human Vision Opens Door of Breakthrough," Prof. Makoto Kaneko of Osaka University, Japan, discussed the basic working principle of increasing the handling time of vision for online high-speed vision systems and showed a couple of application examples, including a 100-G capturing robot, which can capture a dropping object with the maximum acceleration of 100 G, and a system for measuring the deformability of red blood cells, which succeeded in evaluating the pure cell stiffness with 400 cells/s in maximum speed.

The first two semiplenary lectures touched on the various applications of mechatronic systems. Prof. Reza Moheimani of University of Newcastle, Australia, presented a nanoscale application example, "Control of Atomic Force Microscope Microcantilever Dynamics: Mechatronics at the Nanoscale," while Prof. Han Ding of Huazhong University

of Science and Technology, China, gave an update on the latest progress made in a manufacturing application, "New Development of the Dynamics and Control for Five-Axis NC Machining of Complex Surfaces."

The other two semiplenary lectures focused on the specific control methodologies for mechatronic systems. In "Model-Based Nonlinear Control of Mechatronic Systems," Prof. Andreas Kugi of Vienna University of Technology,



Some of the symposium organizers and attendees at the banquet.



A performance at the banquet by the Wenqin Student Art Troupe of Zhejiang University.



The plenary and semiplenary lectures.

Austria, used selected examples to show that, to make full use of the existing powerful nonlinear control concepts, it is necessary to derive tailored (physics-based) mathematical models. He presented various applications ranging from electrical drives, pneumatic fast-switching valves, and a MEMS angular rate sensor to hydraulic systems with smart fluids. In “Rejecting Deterministic and Random Disturbances in Mechatronic Systems,” Prof. Tsu-Chin Tsao of the University of California at Los Angeles, United States, presented the latest tracking or disturbance rejection control design methodologies for mechatronic systems subject to mixed deterministic and random external signals with implementation on several mechatronic systems.

Highlights of the symposium included the panel forum session, “Future Education on Mechatronics,” organized and moderated by IPC Chair Bin Yao. Seven panelists with rich and unique experiences in mechatronics education presented their innovative ideas on how to better educate the next generation of mechatronic engineers: George T. Chiu (U.S. National Science Foundation), Klaus Janschek (Europe), Okyay Kaynak (editor-in-chief-elect, *IEEE/ASME Transactions on Mechatronics*), Andreas Kugi (editor-in-chief, *Control Engineering Practice*), Kok-Meng Lee (editor-in-chief, *IEEE/ASME Transactions on Mechatronics*), Reza Moheimani (Asia), and Masayoshi Tomizuka (America). Together, they gave a global perspective on current practice and future directions in mechatronics education. Conference participants showed a genuine and lively interest in the forum and joined in the discussions after a short presentation by each panelist.

AWARDS

Three inaugural triennial awards by the IFAC Technical Committee on Mechatronic Systems (IFAC TC 4.2, <http://tc.ifac-control.org/4/2/tc-awards>) were given at the conference banquet. The Lifetime Achievement Award is presented by IFAC TC 4.2 to a researcher who has an exceptional history of participation in and contributions to IFAC mechatronic systems activities and who has made

enduring research contributions in mechatronics, either of a fundamental or applied nature. The recipient of the 2013 award was Masayoshi Tomizuka for seminal and pioneering contributions in the field of mechatronics and the control of mechanical systems. The Mechatronic Systems Award is presented to a researcher who has demonstrated sustained outstanding research contributions in mechatronic systems, either of a fundamental or applied nature, and who has a significant history of participation in and contributions to IFAC mechatronic systems activities. The recipient of the 2013 award was Reza Moheimani for outstanding contributions to the design, fabrication, modeling, and control of mechatronic systems for the investigation and engineering of matter at the nanometer scale. The Young Researcher Award is presented to researchers of age 40 years or younger (on March 1 of the year of the award) who have an established history of participation in and contributions to IFAC mechatronic systems activities and who have demonstrated outstanding research contributions in mechatronics, either of a fundamental or applied nature. In 2013 the award was presented to two individuals: to Abu Sebastian, for significant contributions to the field of micro-/nanoscale mechatronic systems spanning areas such as scanning-probe technology, nanopositioning, nanoscale sensing, data storage, and emerging memory technologies, and to Georg Schitter, for substantial contribution to the mechatronic design and control of nanopositioning systems for nanometrology and high-speed scanning probe microscopy.

A best student paper award was given at the symposium. After careful review by the Program Committee and the Award Committee chair, five finalists were selected from the nominations, based on reviews of the written submissions before the conference. The winner was then selected during the conference by the Award Committee independently, considering a number of factors including originality, scientific/technical contributions and clarity in both the written paper and oral presentation. The Award

Committee was chaired by Brad Paden, with members Prof. Doyoung Jeon (Sogang University, Korea), Prof. Makoto Kaneko (Osaka University, Japan), Prof. Andreas Kugi (Vienna University of Technology, Austria), and Prof. Claudio Melchiorri (University of Bologna, Italy). Tomas Tuma from IBM Research, Zurich, received the award for the paper, "Analysis and Design of Multi-Resolution Scan Trajectories for High-Speed Scanning Probe Microscopy."

TECHNICAL TOUR

Frequent technical tours to the State Key Laboratory of Fluid Power Trans-

mission and Control at Zhejiang University were conducted throughout the conference. Research at the laboratory focuses on fluid power transmission and control, applied fluid mechanics, mechatronic system control and signal processing, mechatronic system integration and intelligentization, and mechatronic system and equipment design and manufacture. Over 700 temporary researchers, such as postdoctoral fellows, visiting scholars, and graduate students, work in the lab. Hundreds of research projects are funded by the National Natural Science Foundation of China, the Major State Basic Research



The technical tour, sessions, and breaks.

Development Program of China (973 Program), and the National High Technology Research and Development Program of China (863 Program), and numerous State Key Research Projects, important national science and technology specific projects, and the state priority research projects have been completed in recent years. Some of these projects have been awarded the First Class of the State Science and Technology Progress Prize and the Second Class and the Third Class of the State Invention Prize. The laboratory has become the most important research and development center of fluid power and mechatronic systems and technical training center in China.

VENUE

The conference was held at the Sheraton Hangzhou Wetland Park Resort, located close to the Xixi National Wetland Park and near the main campus of Zhejiang University in the northwest of Hangzhou. Hangzhou is the capital

of Zhejiang province and its political, economic, and cultural center. When Marco Polo came to Hangzhou in the 13th century, he declared it “the most beautiful and elegant city in the world.” With the picturesque scenery of the West Lake located right in the heart of the city, which is also a UNESCO World Heritage site, Hangzhou has always been the most attractive tourist city in China. The aphorism “above is paradise, below is Suzhou and Hangzhou” expresses peoples’ praise of Hangzhou.

SOCIAL PROGRAM

The conference social program included a welcome reception on Tuesday, three lunches, a conference banquet on Thursday, a farewell party on Friday, and a tour of the picturesque West Lake after the conference on Saturday. With the generous support provided by the host institution and the industrial sponsors, both financially and in human resources, the conference participants had a truly wonderful time enjoying the

tasty food, rich culture, and beautiful scenery in Hangzhou.

IFAC MECH 2016

The Seventh IFAC Symposium on Mechatronic Systems will be held at Loughborough University, United Kingdom, on September 6–8, 2016.

THANKS FROM NOC AND IPC

The organizers would like to express their gratitude to all the individuals who contributed to the organization of the conference and thank all the participants for making the conference a great success. The financial and technical support of industrial sponsors Bosch Rexroth China, Festo (China) Ltd., SMC (China) Co., Ltd., and National Instruments are also gratefully acknowledged.

Bin Yao and Huayong Yang
IPC Cochairs

Qingfeng Wang
NOC Chair



» HISTORICAL PERSPECTIVES *(continued from p. 77)*

new IFAC publication *Control Engineering Practice*; I eventually served over ten years on the board. The year 1993 was also when the IFAC Technical Board reorganized itself and invited me to serve as one of the new coordinating committee (CC) chairs. My CC focused on transportation and vehicles, and our job was to coordinate all of the worldwide IFAC conferences related to these specific technologies. I would certainly be remiss if I did not acknowledge Steve Kahne, IFAC president (1993–1996), who no doubt played a role in my receiving the invitations to join these IFAC activities.

After serving as CC chair in 1993–1996, I was asked to be a vice chair of the IFAC Technical Board. After serving as vice chair from 1996 to 2002, I was elected by the IFAC General Assembly to serve as an IFAC officer—IFAC vice president (Technical Board)

for the 2002–2005 triennia. I was also a member of the IFAC Council during 1999–2005. In 2005, I was appointed IFAC advisor, and I was elected an IFAC Fellow in 2006.

TEXAS INSTRUMENTS

Although I have been blessed to be involved with CSS, corporate IEEE, SPIE, and IFAC, the majority of my career was of course spent with TI. My TI managers always supported and encouraged my IEEE and other professional involvement, even though it was not always clear why some of my efforts focused on education and university-related subjects.

After completing my graduate engineering studies, my first significant assignment at TI was as a part of a research team that developed practical pattern recognition techniques. Although we did not use the term,

we developed and patented several techniques that would later be called “genetic algorithms.”

My next major assignment was as part of a technical staff team to provide control system design and development support for company products, and after a few years, I became the manager of the team. This was more-or-less my assignment for the remainder of my TI career. We had great teams of talented control system engineers, and we worked on some really challenging and interesting jobs. We developed practical line-of-sight stabilization and tracking systems, autopilots, missile guidance and control, hard disk drives, motor control, and a variety of other control systems. In 1989, I was elected a TI Fellow, and I was elected IEEE Fellow in 1990.

