AIM Commemorative Forum

25th Anniversary of the AIM Global Rotation: Success Stories and Lessons Learned

Kok-Meng Lee
IEEE Life Fellow, ASME Life Fellow

George W. Woodruff School of Mechanical Engineering
Georgia Institute of Technology
Atlanta, GA 30332-0405, USA

July 17, 2024, 16:00 to 18:00 (Venue: Hampton)

IEEE ASME SETTING THE STANDARD IEEE Robotics & Automation Society IEEE Industrial Electronics Society

Content

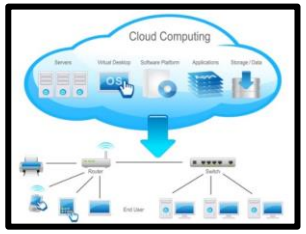
1. Societal Timeline-Mechatronics
2. IEEE/ASME TMECH and AIM
3. AIM Global Rotation
4. 1st AIM in USA and impacts

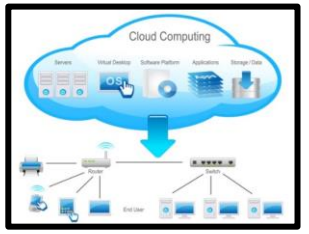
Societal Timeline Motivating technology trends

Trade War (Manuf.) — 9-11 WTC Event (2001.9.11) — Trade War (Manuf.)

1980 — 1990 — 2000 — 2010 — 2020 — 2030

1980	1990	2000	2010	2020	2030
μ-processors Emerge	Information highway (Internet, web)	Human-centered Safety	Intelligent Manufacturing	New Challenges	
		SARS (2002.11 ~2003.6)	Bird flu (2013 ~2017)	COVID 19 (2019 ~)	



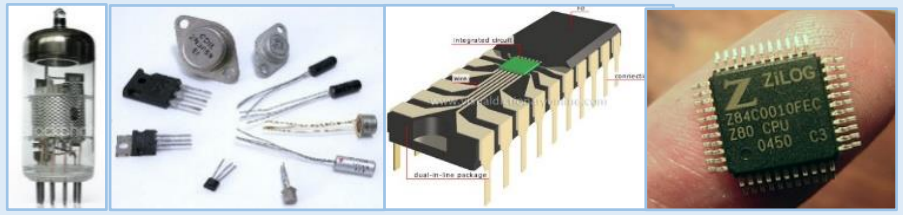


Room (1960+) ⇨ Desktop (1985+) ⇨ Hand (2000+) ⇨ Cloud (2010+)

- New materials
- Metal 3D printing
- Green energy
- Electric vehicles
- AI services
- ChatGPT

Rapid advances in 4C technologies (Computing, Communication, Control, Consumer product)

1960's	Late 1960's	Late 1970's	Early 1980's
Vacuum tube	Transistor	Integrated circuit	Microprocessor



Mechatronics

Digital Machine Vision

Late 1980
DVT sensor
(Now Cognex)

Digital Machine Vision
S. Dickerson, K-M. Lee
US Patent 5146340
European Pat. 0549736
Canadian Pat. 2088357

IEEE/ASME TMECH 1996 ~
AIM 1997 ~

Societal Timeline Motivating technology trends

1980 — μ-processors Emerge — Mechatronics

1990 — Information highway (Internet, web)

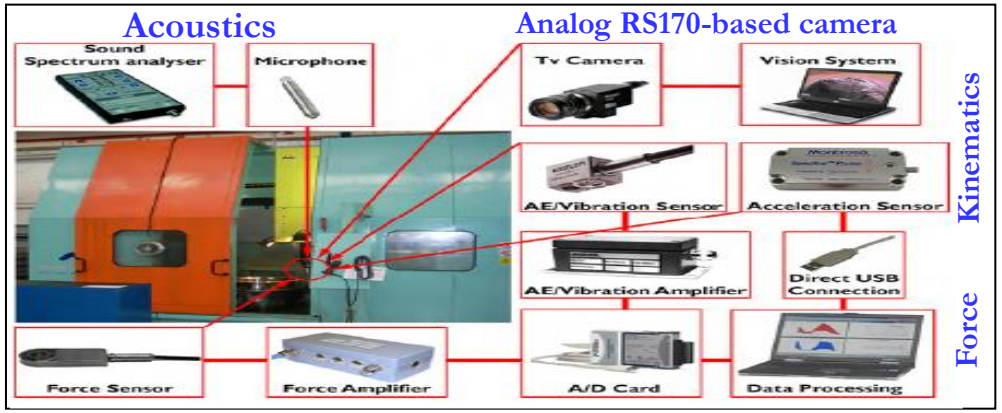
2000 — Human-centered Safety — IEEE/ASME TMECH (1996~) AIM (1997~)

2010 — Intelligent Manufacturing

2020 — New Challenges

Rapid advances in 4C technologies (Computing, Communication, Control, Consumer product)

Electronics–inspired drives growing demand for semiconductor technologies.



Machine Vision

Accessories

- Power supply
- Power amplifier
- Input/output
- Data acquisition
- Signal-processing
- Data storage
- Program update

Signals and systems → **Information** → **Knowledge**

Signals and systems	Information	Knowledge
Lumped-parameter	Distributed-parameter	Physics-based,
Point-based measurements	Field-based measurements	control-oriented model

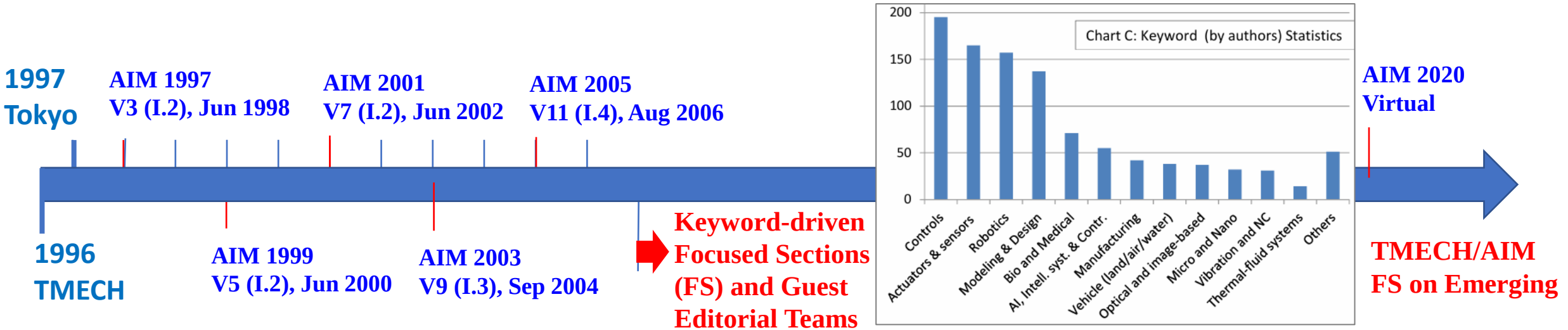
IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

IEEE Industrial Electronics Society (IES), Robotics and Automation Society (RAS)
ASME Dynamic Systems and Control Division (DSCD)

AIM Inaugurated in 1997 as an offspring flagship conference of *IEEE/ASME Transactions on Mechatronics* (TMECH).

- Build a community of mechatronics (fostering young members) to serve as pipelines of potential authors, technical editors, and future leaders in mechatronics-related areas.
- Provide a platform to promote emerging topics, exchange ideas, present technical achievements, and discuss future directions.



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AIM 1997
Tokyo, Japan

AIM 1999
Atlanta, USA

AIM 2001
Como, Italy

AIM 1997 Inaugural
General Chair
Hideki Hashimoto
Local Arrangement Chair
Shigeki Sugano

NSF (US) Support
General Co-Chair
Kok-Meng Lee (PI)

AIM 1999
General Chair
Kok-Meng Lee

AIM 2001
General Chair
Bruno Siciliano

1997
Tokyo

1996
TMECH

Hideki Hashimoto
Chuo Univ., Japan

Kok-Meng Lee
Georgia Inst. of Tech., USA

Shigeki Sugano
Waseda Univ., Japan

Bruno Siciliano
Univ. of Naples Federico II, Italy

AIM 2003 General Chair

AIM 97 (June 16-20, Waseda Univ., Tokyo, Japan)
4 Plenary presentations, 3 Workshops.
8 Sessions (150 papers),
400 Authors or co-authors (256 Registrants)

Demographical distribution of authors and co-authors

ASIA	170	EUROPE	103
48.4% Japan	113	29.3% France	33
Korea	33	Switzerland	31
China	12	German	10
Hong Kong	10	United Kingdom	10
Taiwan	2	Finland	5
		Spain	4
N. AMERICA	75	Slovenia	3
United States	65	Italy	3
Canada	10	Turkey	2
21.4%		Hungary	1
Others	3	Lithuania	1

From left
Hideki Hashimoto
Kok-Meng Lee
Shigeki Sugano

AIM2005 General Chair

AIM2012 General Chair

AIM 1997 Plenary

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AIM2010 General Chair

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LIST OF U.S. PARTICIPANTS FUNDED BY THIS NSF GRANT

NSF Project DMI-9706642: 1997
IEEE/ASME Advanced Intelligent Mechatronics
PI: Kok-Meng Lee

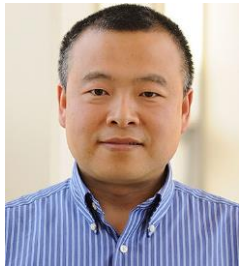
IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

Santosh Devasia
Univ. of Washington
USA

AIM 2023
Seattle, WA

AIM 2020
Virtual



Jingang Yi
Rutgers Univ.
USA

AIM2024
Boston, MA

Xiang Chen
Univ. of Windsor
Canada

AIM 2005
Monterey, CA

Ning Xi
Univ. of Hong Kong
China

AIM 1999
Atlanta, GA

Kok-Meng Lee
Georgia Inst. of Tech.
USA

IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

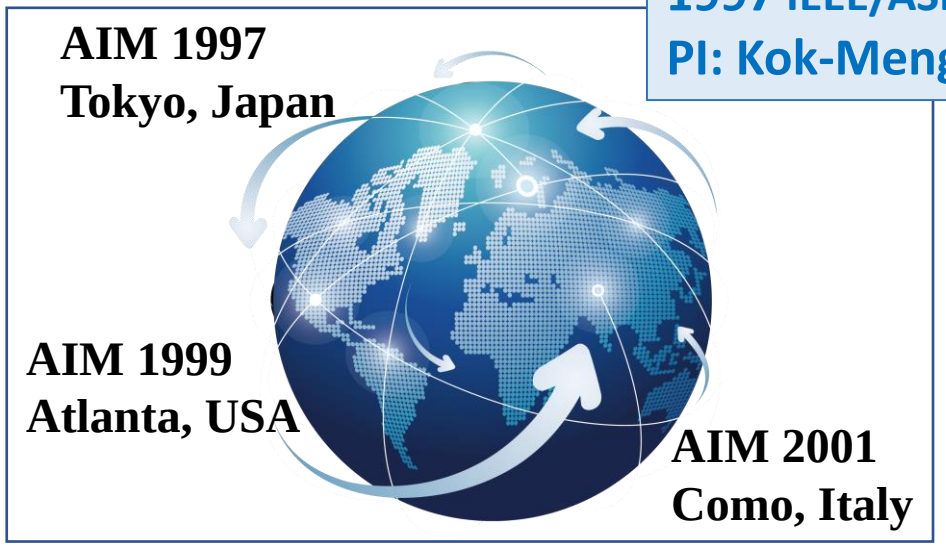
NSF Project DMI-9706642 (International travel grant)
1997 IEEE/ASME Advanced Intelligent Mechatronics
PI: Kok-Meng Lee, Georgia Inst. of Tech.

AIM1997 Inaugural

General Chair
Hideki Hashimoto

General Co-Chair
Kok-Meng Lee

Local Arrangement Chair:
Shigeki Sugano



NSF Student Travel Grants:
AIM2005 (PI: Bin Yao, Purdue Univ.)
AIM2023 (PI: Juan Ren, Iowa State Univ.)
AIM2024 (PI: Yan Wan, Univ. of Texas at Arlington)

Society Student Travel Grants:
AIM2023 (GC D. Santosh): ASME/DSCD.
AIM2024 (GC X. Chen): ASME/DSCD and IEEE/IES.

1996 TMECH

1997 Tokyo

1999 Atlanta

2005 Monterey

2008 AIM Annual conference

2018 Virtual

2020 Virtual

2023 Seattle

2024 Boston

TMECH EIC (Kok-Meng Lee, 2008-2013)
2008 (Scholar One)
TMECH Best Paper Award
ASME/DSCD Best Conference Paper on Mechatronics

First AIM CEB (Hiroshi Fujimoto)

TMECH/AIM FS (Inaugural)

IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

AIM 2010 Montreal, Canada

AIM 2008 Xi' an, China

AIM 2009 Singapore

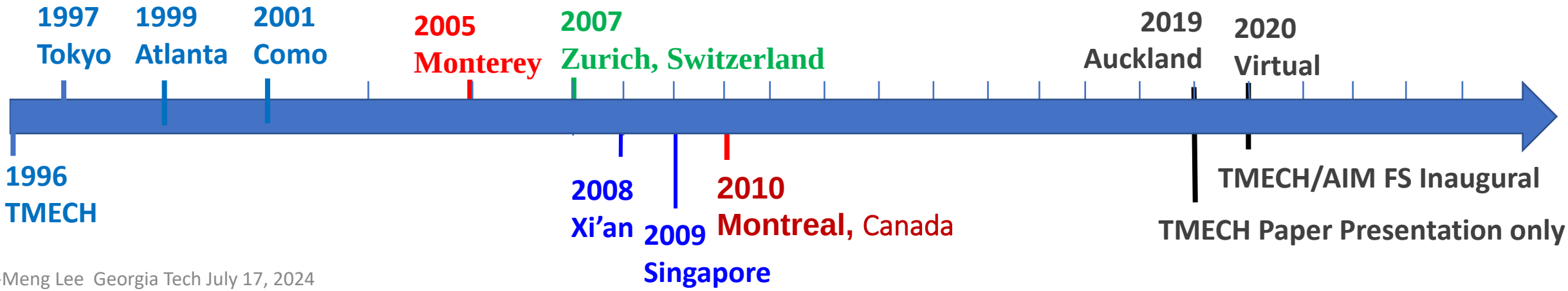
AIM 2005 Monterey, USA

AIM 2007 Zurich, Switzerland

AIM Global Rotation Impact on TMECH Submission Growth

Region (%)	2012	2011	2010	2009	2008	2007	2006
1-6 (USA)	29.9	26.7	25.1	30.6	24.8	24.2	42.6
7 (Canada)	9.0	13.1	8.1	11.2	8.3	10.7	9.6
8 (Europe/Africa)	22.1	23.0	27.8	21.1	38.2	30.3	16.9
9 (C/S America)	1.6	0.7	0.0	0.8	0.3	0.0	2.4
10 (Asia/Pacific)	37.5	36.5	39.1	36.4	28.3	34.8	28.5

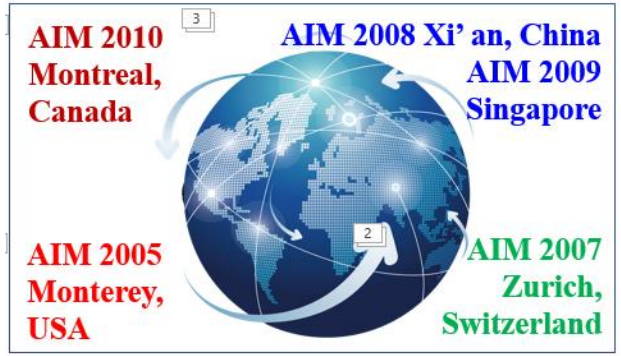
AIM 2010 AIM 2008, 2009 AIM 2007 AIM 2005



IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

AIM Global Rotation Impact on TMECH Submission Growth



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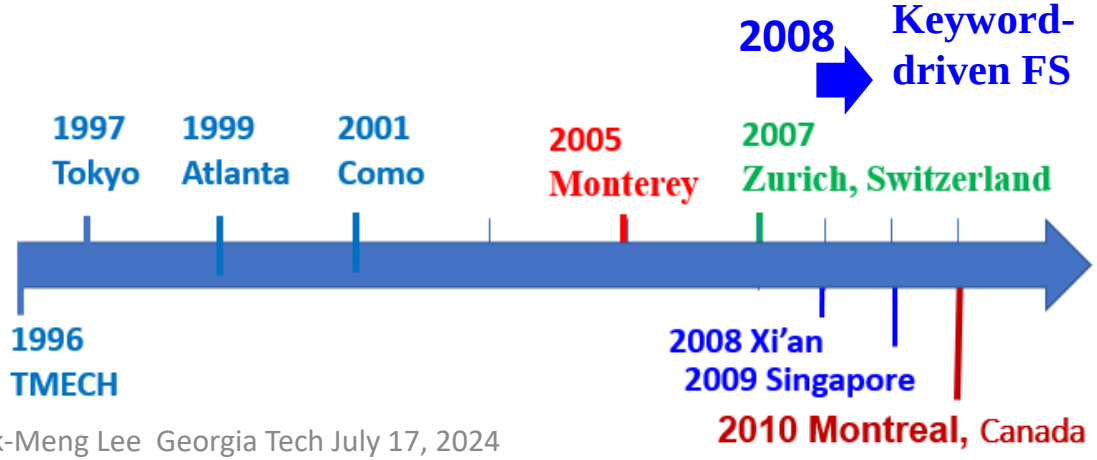
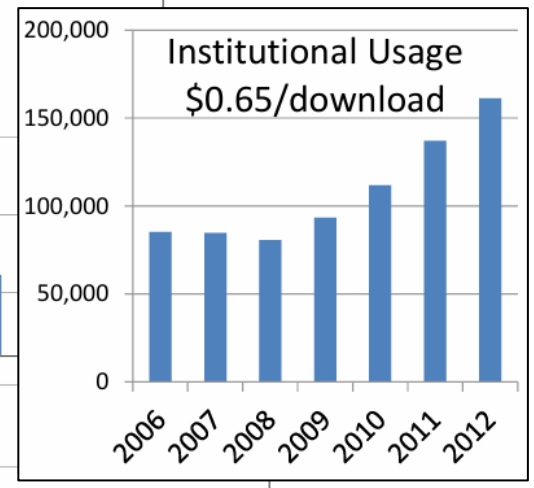


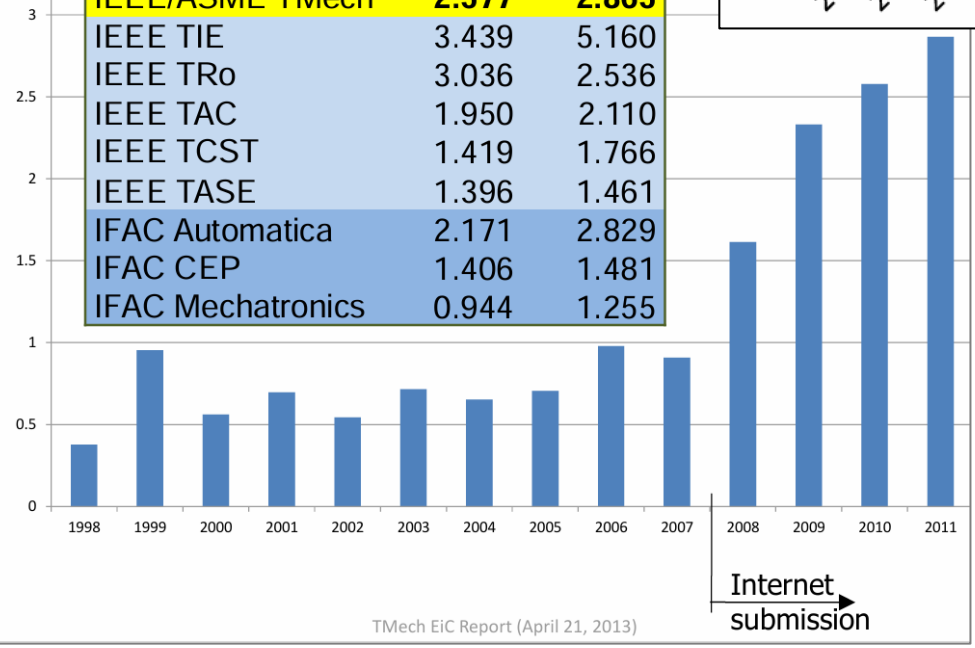
Self Assessment (1)

Impact Factor over years

Journals	2008	2009
IEEE/ASME T-Mech	1.614	**2.331**
IEEE T-Ro	2.656	**2.035**
IFAC CEP	1.871	**1.943**
IEEE T-CST	2.13	**1.858**
IFAC Mechatronics	1.434	**1.198**



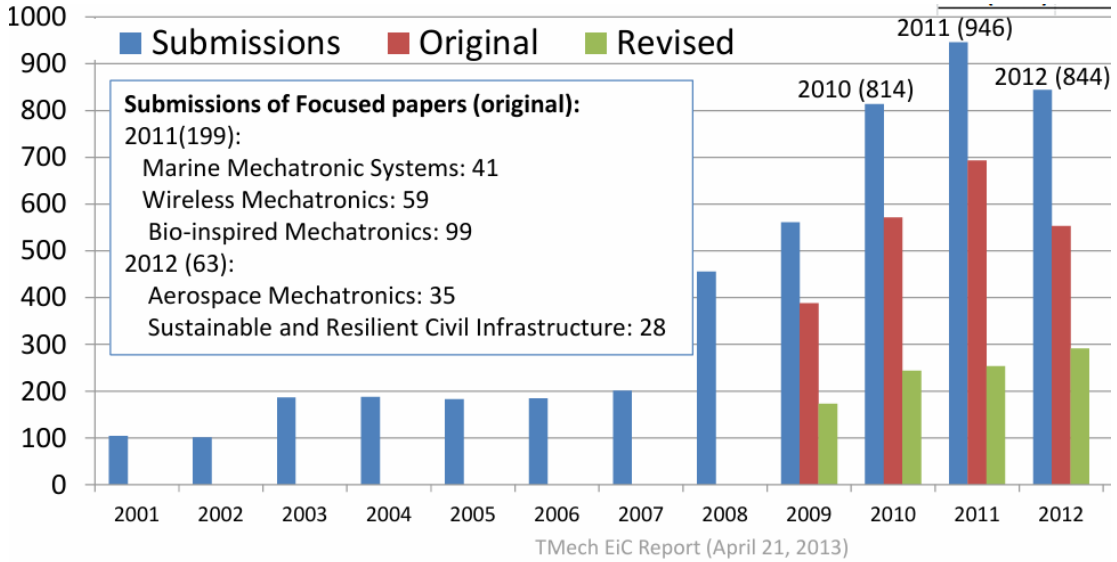
Journals	2010	2011
IEEE/ASME TMech	**2.577**	**2.865**
IEEE TIE	3.439	5.160
IEEE TRo	3.036	2.536
IEEE TAC	1.950	2.110
IEEE TCST	1.419	1.766
IEEE TASE	1.396	1.461
IFAC Automatica	2.171	2.829
IFAC CEP	1.406	1.481
IFAC Mechatronics	0.944	1.255



IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

Keyword-driven Focused Section (FS) and guest editorial team



Mechatronics for Sustainable and Resilient **Civil Structures** (Dec 2013)
Aerospace Mechatronics (August 2013)
Bio-inspired Mechatronics (April 2013) 99 submissions, 200 pages
Wireless Mechatronics (June 2012)
Marine Mechatronic Systems (February 2012)
Sensing Technologies for **Biomechatronics** (October 2011)
Electromagnetic Devices for **Precision Engineering** (June 2011)
Electroactive Polymer Mechatronics (February 2011)
Surgical and Interventional **Medical Devices** (December 2010)
Optomechatronics (August 2010)
Healthcare Mechatronics (April 2010)
Anthropomorphism in Mechatronic Systems (December 2009)
Mechatronics for **MEMS and NEMS** (August 2009)
Mechatronics in **Multi Robot Systems** (April 2009)

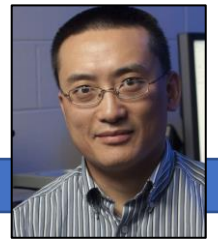
TMECH-AIM FS on Emerging topics (Inaugural, AIM 2020)

TMECH EIC (2020-2022)

I-Ming Chen
Nanyang Tech. Univ., Singapore

Founding FS Editorial Chair (2020-2022)

Xiang Chen
Univ. of Windsor, Canada



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Qingze Zou
Rutgers Univ., USA

AIM2020 General Chair

Jingang Yi
Rutgers Univ., USA

AIM2020 Program Chair

Xiaobo Tan
Michigan State Univ., USA

AIM CEB (2018-2020)

Chair

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Univ. of Tokyo, Japan

Secretary

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Yokohama Nat. Univ., Japan

IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

IEEE Industrial Electronics Society (IES), Robotics and Automation Society (RAS)
ASME Dynamic Systems and Control Division (DSCD)

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- Provide a platform to promote emerging topics, exchange ideas, present technical achievements, and discuss future directions.

Objectives of the AIM 1999 (1st AIM in the US)

- **Educational infrastructure for Mechatronics.**
- **Research opportunities for Mechatronics.**
- **Platform to discuss emerging topics of Mechatronics.**
- **Rapidly disseminate research findings and recognize contributions to Mechatronics.**

AIM 1999 Highlights:

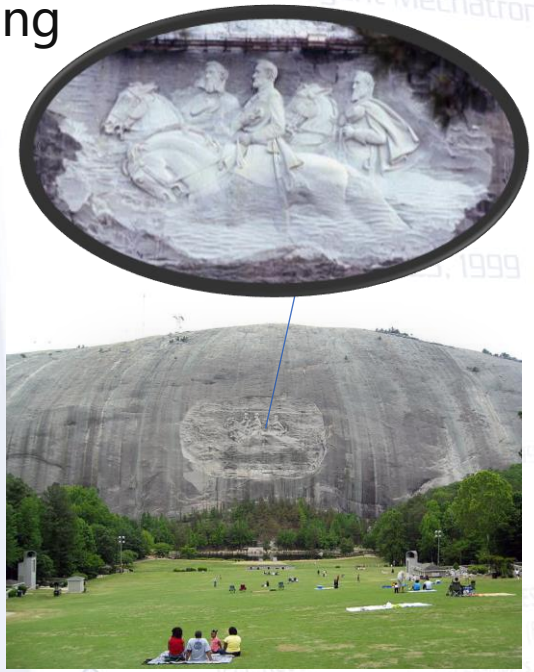
- **Rapidly disseminate archival research and recognize contributions:**
  - **E-media announcing technical programs and abstracts**
  - **Full-length (3 peer-reviewed) papers.**
  - **IEEE *eXplore* Proceedings of full-length papers**
- **Platform to discuss emerging topics.**
  - **Keynote speakers and plenary lectures.**
  - **Tutorials and Workshops**
- **Research opportunities for Mechatronics.**
  - **Panel discussion on research funding opportunities**
  - **Industry tours**
- **Educational infrastructure for Mechatronics.**
  - **Round Table on Infrastructure for Mechatronics Education**
  - **Exhibits**

AIM 1999 (Atlanta, GA)

General Chair
Kok-Meng Lee
Georgia Inst. of Tech. USA

- **E-Media**
- **Full-length (3 peer-reviewed) papers**
- **IEEE/ASME AIM (Full-Paper) Proceedings**

Stone Mountain's carving



[Stone Mountain Memorial Association (stonemountainpark.org)]

AIM '99

Welcome
Final words of appreciation
Looking Forward to AIM'01
Proceedings
Organization
Information
Program at a Glance
Technical Program
Abstracts
Keynote Speakers
Plenary Lectures
Tutorial
Panel Discussion
Round Table Discussion
Session Chair Index
Author's Index
Tours
Registration
Exhibits
Banquet Information
Hotel Reservations
Atlanta Area Information
Author's Instructions
About the Background Image
Archival-final-report

1999 IEEE/ASME International Conference on Advanced Intelligent Mechatronics

AIM'99

co-sponsored by

IEEE Industrial Electronics Society
American Society of Mechanical Engineers
IEEE Robotics and Automation Society

In cooperation with

Institute of Electrical Engineers of Japan (IEEJ)
Japan Society of Mechanical Engineers (JSME)
Society of Instrument and Control Engineers (SICE)
Japan Society of Precision Engineers (JSPE)
Robotics Society of Japan (RSJ)
Institute of Systems, Control, and Information Engineers (ISCIE)

September 19 - 22, 1999
Renaissance Atlanta Hotel - Atlanta, Georgia USA

http://aimrl.gatech.edu/AIM99/

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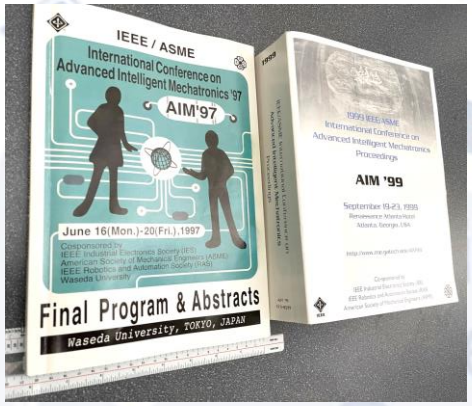

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IEEE/ASME (AIM) International Conference on Advanced Intelligent Mechatronics

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Proceedings | **All Proceedings** | Popular

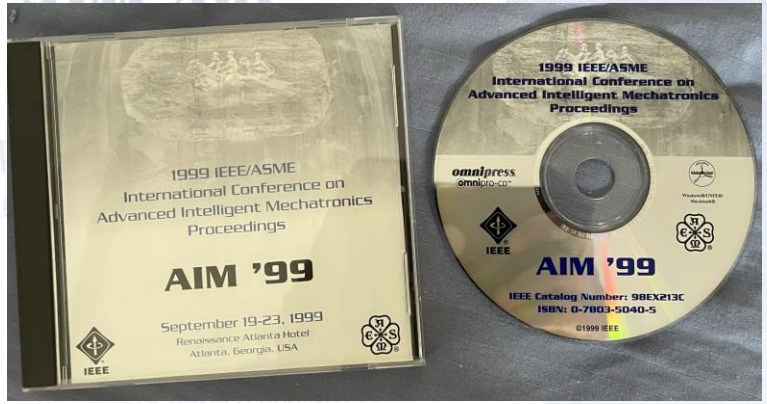
All Proceedings

2001 IEEE/ASME International Conference on Advanced Intelligent Mechatronics. Proceedings (Cat. No.01TH8556)
Location: Como, Italy

1999 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (Cat. No.99TH8399)
Location: Atlanta, GA, USA

1st (AIM1999) Full-length-paper proceedings (3 peer-reviewed)

Proceedings of IEEE/ASME International Conference on Advanced Intelligent Mechatronics
Location: Tokyo, Japan



2005 IEEE/ASME International Conference on
Advanced Intelligent Mechatronics
24-28 July, 2005, Monterey, California, USA

Procedures for Final Paper Submission

STEP 1: Preparation of IEEE eXplore Compatible Manuscript

IEEE PDF eXpress™

STEP 2: On-line Registration

The registration will be available at the time of final submissions and link for registration and over length page charge payment will appear on the paper submission page.

STEP 3: Submission of Final IEEE Xplore-compatible Manuscript

All IEEE Xplore-compatible manuscript submissions must be done electronically through the conference submission web site:

https://ras.papercept.net/conferences/scripts/start.pl

STEP 4: Submission of Copyright transfer form

The copyright transfer process is now fully electronic and integrated in the submission process and hence you no longer need to download and send a signed copy of the copyright form.

PaperCept:

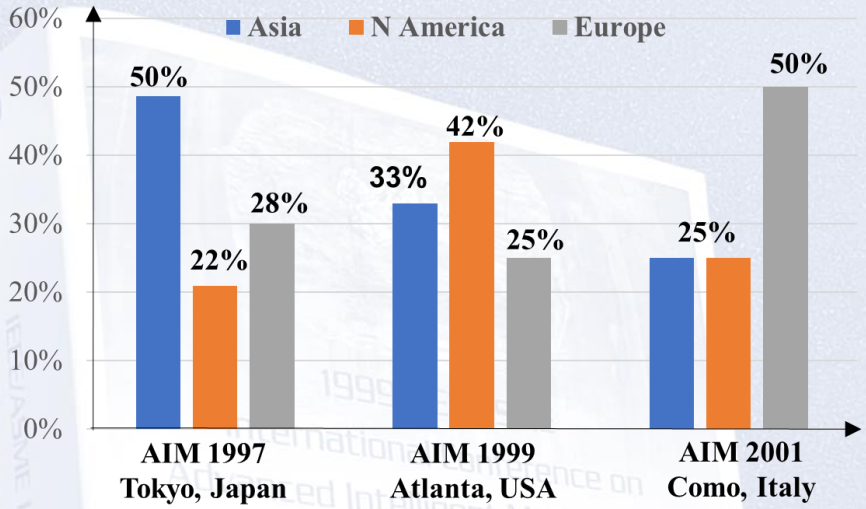
AIM 2005 Fully integrated paper Submission

→ Review
→ Decision
→ Registration
→ IEEE *eXplore* compatible
→ Schedule

IEEE Robotics and Automation Society

Find your own or someone else's PIN
Remember that each subdomain has its own people database

Lee	Kok-Meng	Georgia Institute of Technology	10001



- E-Media
- Full-length (3 peer-reviewed) papers
- IEEE/ASME AIM (Full-Paper) Proceedings

T. J. Tarn
Publication Chair

1999 IEEE/ASME International Conference on Advanced Intelligent Mechatronics
September 19 - 23, 1999 - Renaissance Atlanta Hotel, Atlanta, Georgia USA

WELCOME

On behalf of the Institute of Electrical and Electronics Engineers (IEEE) and the American Society of Mechanical Engineers (ASME), we are glad to host you at the 1999 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM '99). The purpose of this biennial conference, following the footsteps of the first one in Tokyo, Japan, in 1997, is to promote activities in various areas of mechatronics by providing a forum for exchange of ideas, presentation of technical achievements, and discussion of future directions. The theme of the conference is Informatics in Mechatronics.

This year, a total of 24 countries have submitted papers with overall breakdown of about 1/3 for each of the three greater geographic regions (America, Asia and Europe). The technical program incl of 171 papers an nal printed ve rior to the meeti Internatio conscienti conferenc fair evalua invested i anc tee, and

tember 19 with a to Wednesday. After ie, respectively:

AIM'99 Program
4 Plenary presentations
181 Technical papers
36 Sessions

Kok-Meng Lee
General Chair

Audiences
Opening (Kok-Meng Lee)

Bruno Siciliano
General Co-Chair

IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

Peter Will

Kazuo Tanie

Paolo Dario

Toshio Fukuda

1999 IEEE/ASME International Conference on Advanced Intelligent Mechatronics

September 19 - 23, 1999 - Renaissance Atlanta Hotel, Atlanta, Georgia USA

KEYNOTE SPEAKERS

Plenary Lecture 1
Monday from 8:10 to 9:00
Atlanta A/B
The Mix of Computation, MEMS and Regular Materials
Peter Will, USC/Information Sciences Institute, California, USA

Plenary Lecture 2
Monday from 9:00 to 9:50
Atlanta A/B
Mechatronics - Past, Present and Future
Kazuo Tanie, Mechanical Engineering Laboratory, AIST-MITI, Tokyo, Japan

Plenary Lecture 3
Tuesday from 8:10 to 9:00
Atlanta A/B
Advances in Micromechatronics
Paolo Dario, Scuola Superiore Sant'Anna, Pisa, Italy

Luncheon Keynote
Tuesday from 11:30 to 13:20
Mechatronics in the Future
Toshio Fukuda, Nagoya University, Nagoya, Japan

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TUTORIAL

Micro/Nano-Mechatronics for Nanotechnology

Michael Falvo
University of North Carolina at Chapel Hill
Chapel Hill, NC, USA

Metin Sitti
University of Tokyo
Tokyo, Japan

Prof. Dr. Metin Sitti is a Professor in School of Medicine and College of Engineering at Koç University. He is also the current President of Koç University and an Honorary Professor at University of Stuttgart, Germany. …
…**PhD degree from University of Tokyo, Japan (1999) in electrical engineering**.

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PANEL DISCUSSION

All participants are invited.

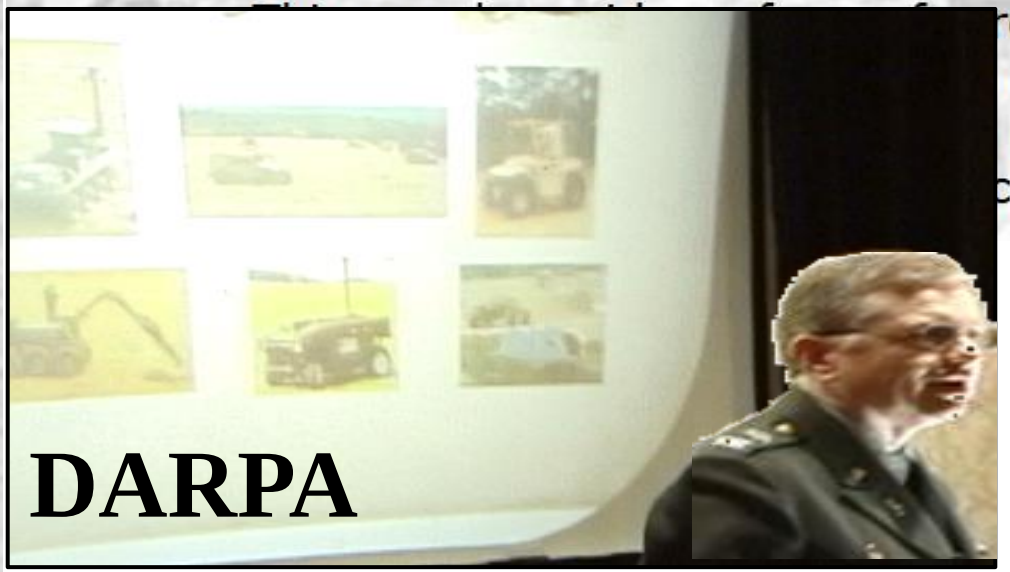
Monday from 9:50 to 10:40

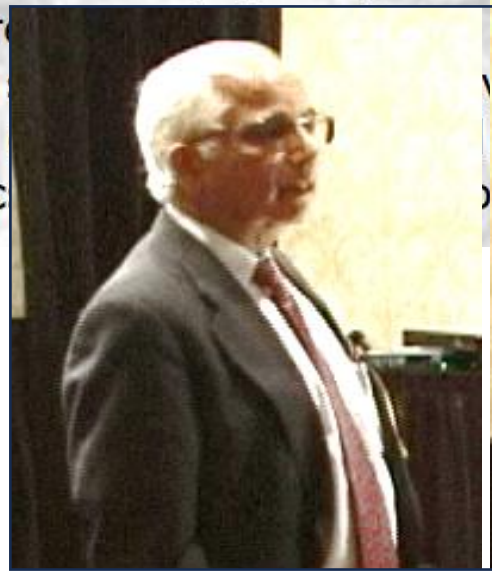
NSF /DARPA

Panel on **Research Funding Opportunities on Mechatronics**
Organized by J. Xiao, National Science Foundation, USA

Panelists: Jing Xiao, Rajinder Khosla, NSF; Mark Swinson, DARPA

Abstract





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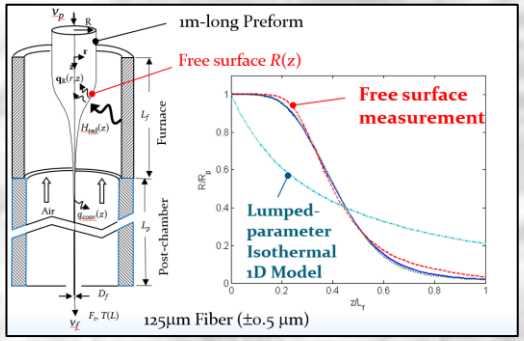
INDUSTRY TOURS

Thursday 9:00 to 16:00

Tour 1: Ford and Lucent

Tour 2: GM and Lockheed



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RESEARCH LAB TOURS

Tuesday 15:00 to 18:00
Georgia Tech/GCATT
Organized by Gary McMurray (Georgia Institute of Technology, USA)
Chen Zhou (Georgia Institute of Technology, USA)

Center for Board Assembly Research (CBAR) is a multidisciplinary research center for greater productivity in circuit board assembly.

Rapid Prototyping and Manufacturing Institute (RPMI) is to further the deployment of rapid prototyping and manufacturing through education.

Packaging Research Center (PRC) is dedicated to the development of the packaging technologies for the twenty-first century.

The Interactive Media Technology Center (IMTC) is a research, design, and education center focusing on digital media processing applied to technology, education, and culture.

The Center of Signal and Image Processing, part of the Georgia Tech School of Electrical and Computer Engineering, is at the forefront of research and education in this important field.

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ROUND TABLE

All participants are invited.

Wednesday from 8:00 to 8:50

Round Table on **Infrastructure for Mechatronics Education**
Organized by I. Ebert-Uphoff, J. Gardner, W. Murray and R. Perez, USA

Speakers: Edward Carryer, Stanford University, USA; Kevin Craig, Rensselaer Polytechnic Institute, USA; John Gardner, Pennsylvania State University, USA; Tai-Ran Hsu, San Jose State University, USA; Dawn Tilbury, University of Michigan, USA; Ismet Erkmen, Middle East Technical University, Turkey

Abstract
The purpose of this round table is to stimulate a conference-wide discussion of the needs to be addressed to facilitate an effective mechatronics education and to inform industry of these needs. Issues to be addressed include the infrastructure in terms of textbooks, software and hardware components. Experts from academia who are very active in mechatronics education will serve as speakers. Numerous exhibitors have been invited to attend. Questions to be discussed by the speakers and the audience include:

- What tools would make it easier to implement a Mechatronics curriculum?
- What kinds of books, software or hardware have you been looking for, but did not find?
- What would you put as #1 on your wish-list?

Exhibitors:
DVT
Prentice Hall
Quanser Consulting
Shandor Motion Systems

Dawn Tilbury

Tai-Ran Hsu

Edward Carryer

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Guest Editorial

THE second IEEE/ASME International Conference on Advanced Intelligent Mechatronics was held in Atlanta, GA, September 19–22, 1999. The purpose of this biennial conference, following the footsteps of the first one in Tokyo, Japan, in 1997, 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.

The conference was co-sponsored by the IEEE Industrial Electronics and IEEE Robotics and Automation Societies and the ASME Dynamic Systems and Control Division, in cooperation with the Institute of Electrical Engineers of Japan (IEEJ), Institute of Systems, Control, and Information Engineers (ISCIE), Japan Society of Mechanical Engineers (JSME), Japan Society of Precision Engineers (JSPE), Robotics Society of Japan (RSJ), and Society of Instrument and Control Engineers (SICE). (**Ed. note:** K.-M. Lee and B. Siciliano were the General Chair and Co-Chair, respectively.)

education is included, which is the outcome of two invited sessions and a roundtable discussion held at the conference.

The issue begins with a paper by Ho, Masuda, Oda, and Stark on a *distributed teleoperating system* to be used in a hazardous environment, namely, in the vicinity of an active volcano. Key features of the system are supervisory control for reduced human attendance and the GPS feedback and image processing component for robust vehicle pose recovery. Remarkably, the control architecture is integrated with current Web technologies in view of future expansions. Somewhat related to the challenging integration aspects of information automation is the paper by Shen, Huang, and Menq on a *sensor fusion system*. Specifically, the measurements provided by a coord
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a whole

TMECH FS on AIM 1999
Vol. 5, Issue 2, June 2000

Speakers:

Edward Carryer, Stanford Univ., USA
Kevin Craig, Rensselaer Polytechnic Inst. USA
John Gardner, Pennsylvania State Univ., USA
Tai-Ran Hsu, San Jose State Univ., USA
Dawn Tilbury, Univ. of Michigan-Ann Arbor, USA
Ismet Erkmen, Middle East Tech. Univ., Turkey

Preparing for the Next Century: The State of Mechatronics Education

Imme Ebert-Uphoff, John F. Gardner, William R. Murray, and Ronald Perez

***Abstract*—This paper is based on a series of special events focusing on mechatronics education at the 1999 IEEE/ASME International Conference on Advanced Intelligent Mechatronics. The series consisted of two invited-paper sessions on "Teaching of Mechatronics" and a conference-wide roundtable discussion concerned with "Infrastructure for Mechatronics Education." In this paper, a framework is presented for comparing various aspects of mechatronics courses based on these events.**

***Index Terms*—Education, mechatronics.**

Thank you,

the community of mechatronics,

for your ongoing support!

Signals/systems ➡ Information ➡ Knowledge ➡ Human-like Intelligence