



Newsletter

No. **9** E
March 1, 2006

The 21st Century COE Program
Mechanical Systems Innovation, The University of Tokyo

Special Issue on Human Resource Development



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International Research and
Education Center for Mechanical
Systems Innovation

Preface

The growth and maintenance of internationally competitive industries are indispensable for the invigoration and sustainable development of the Japanese economy in the knowledge-based society of the 21st century, as technology rapidly progresses along with globalization. At this time graduate school education is expected to develop human resources that can lead innovation in a wide range of engineering fields.

Therefore, in this COE program "Mechanical Systems Innovation," we are aiming to form an internationally-attractive educational base by sharing our vision, which is to develop leaders who possess "creativity, a pioneering ability for untrodden fields, an international perspective, an ability in project planning and management associated with a sense of responsibility --all of these qualities built on a firm basic education and highly-specialized intellect".

As for the needed educational reform, which has in the past been a matter of internal discussions among faculty members, we have been providing the opportunity for open debates that involve not only industry and relevant ministries but also the students who are receiving the education. We are organizing various requirements for graduate school education that come from industry and seek to extract the universal elements.

Through these activities, some new educational programs have already been suggested and carried out. This newsletter introduces those new trial programs for human resource development.

Industry-Faculty Council for Human Resource Development

History

On June 3, 2005, the 1st Industry-Faculty Council for Human Resource Development Council was held. At this council 13 business promotion members of different companies, which are major workplaces for graduates of the school of engineering at the University of Tokyo, and 21 COE project promoters gathered in a hall. It was confirmed that we cooperatively promote educational reform for the graduate school via three mainstays: this council (the Industry-Faculty Council for Human Resource Development), the Industry-Government-Academia Interaction Meeting for Human Resource Development Meeting, and the Cross-Department Doctoral Course, which is based on the common awareness that the fostering of researchers and technical engineers is crucial for the future aging society in which there will be fewer children.

At the Executive Meeting held on Tuesday, July 19, 2005, the Intramural Education Working Group (WG) and the Joint Academic-Industrial Education Working Group were established. In the former, we intend to develop “specialty” and “literacy” by improving the lecture system at the University of Tokyo, whereas in the latter we aim to cultivate “competency”, which is difficult to develop through coursework alone.

In a series of WG meetings held in August, October, and November, educational requirements from industries were organized into these three categories: “specialty”, “literacy”, and “competency”. On this basis, faculty members afterwards presented lecture groups corresponding to the requirements of “specialty” and “literacy”. Representatives from the industries presented an internship plan for the development of “competency”.

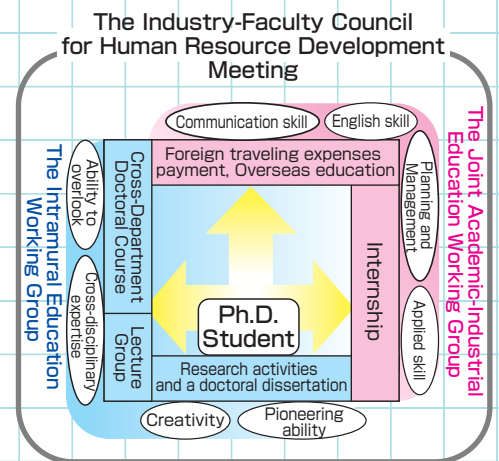
The discussions described above were summarized at the 3rd Industry-Faculty Council for Human Resource Development Meeting held in December 2005. Regarding intramural education, the schematization of lectures and the introduction of multi-supervisors and an adviser for lecture choice were suggested.

From the Joint Academic-Industrial Education Group, a long-term internship program based on collaborative research and a short-term skill-training program were put into place.

Future work

These suggestions will be tried in the Cross-Department Doctoral Courses, “Mechanical Systems Innovation 1” and “Mechanical Systems Innovation 2,” to be offered in the next fiscal year.

Although it is difficult to achieve concrete results in a short time, we will continue the open discussion on the reform of the graduate school education among all stakeholders: the industry, government, faculty members, and students.



Opening address by Prof. Nobuhide Kasagi, the Program leader

Requirements from industry and education corresponding to them

	Requirements	Corresponding Education
Specialty	<ul style="list-style-type: none"> Highly-specialized knowledge Creativity Pioneering ability 	<ul style="list-style-type: none"> Systematization of lectures Adviser system Cross-Department Doctoral Course
Literacy	<ul style="list-style-type: none"> Ability to overlook Multidisciplinary Presentation skill English skill 	<ul style="list-style-type: none"> English meeting Foreign traveling expenses payment Open Seminars
Competency	<ul style="list-style-type: none"> Ability to establish problems Planning and Management abilities Applied skill Leadership 	<ul style="list-style-type: none"> Cross-Department Doctoral Course Study abroad Internship

Industry-Academia-Government Interaction Meeting for Human Resource Development

In this meeting, we have been inviting well-informed persons from ministries, industries and universities every few months. They give us lectures on the present condition of the graduate school education and what it should be. They are of particularly high interest to Ph.D. students, and vigorous discussions are conducted after the lectures. Till now, we have invited three persons from ministry, industry and university, respectively. The followings are their brief reports.

1st Industry-Government-Academia Interaction Meeting for Human Resource Development

Date : March 15, 2005

Speaker : Yuji Sakakibara (Manager, Ministry of Education, Culture, Sports, Science and Technology [MEXT])

Subject : Effort of MEXT toward Advanced Human Resource Development

When we reach the age of puberty in Japan, there is a strong requirement that we develop our personalities and create knowledge-based values in preparation for the coming small-population society. In this lecture, the activities of the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) concerning human resource development were introduced. In addition, the need to diversify the career paths of young researchers and to introduce internship programs coordinated by the academic-industrial alliance were pointed out. In a Q&A session, there was an earnest demand from a student to reinforce the financial support given by government to young researchers.

2nd Industry-Government-Academia Interaction Meeting for Human Resource Development

Date : April 26, 2005

Speaker : Mitsuhiro Arinobu
(Managing Director, Toshiba Co., Ltd.)

Subject : Expectations and Realities for Ph.D.s

More of an ability to unify multidiscipline expertise and people is required in industry, while sticking to your own way is valued in academia. In this lecture, the differences between postdoctoral career paths in Japan and those in the U. S. and Europe were shown. It was also pointed out that an education program that cultivates management ability and applied skills is needed in order to increase the number of Ph.D.s who participate actively in industry.

In a Q&A session, one student asked the lecturer: "After entering a company, how has graduate school education been useful in your career?". The lecturer answered that "The experiences of establishing problems on my own and collaborating with neighboring people are significant".



Presentation by Dr. Mitsuhiro Arinobu

3rd Industry-Government-Academia Interaction Meeting for Human Resource Development

Date : June 21, 2005

Speaker : Hideo Ohashi
(President, Kogakuin University)

Subject : A Viewpoint on the Development of an Engineer

By tracing the etymology of "Engineering", the lecturer discussed a Japanese conceptual problem: much has been made of the aspect of "study" alone, while the original meaning of the word "profession" has been lost. Construction of a system that prevents technical abuses and that allows for participation in technical choices with society is required for future engineers.

In a Q&A session, there was active discussion on establishing universal qualifications for engineers and the positioning of scientists and engineers.



Question to Dr. Hideo Ohashi

Cross-Department Doctoral Course

Joint UT-ETH Exchange Program

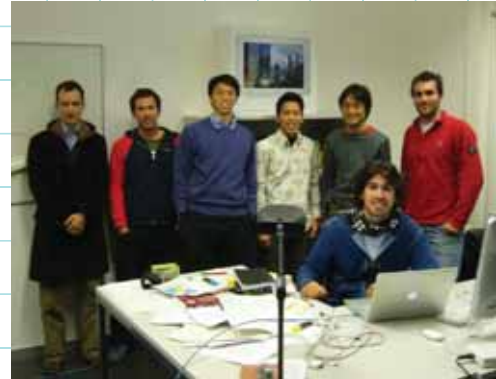
The objective of this program is to cultivate internationality, communication and project management skills for young researchers through international exchange with the Swiss Federal Institute of Technology in Zurich (ETH, Zurich), which is an overseas base of 21 COE.

Students who hoped to apply for this program were obligated to make contact with their host professors, suggest research plans and obtain the host professor's informal consent for acceptance. Next, five research assistants were selected after an English hearing. They were dispatched to Zurich, Switzerland, with a project research associate for the month from October 1, 2005 to November 1, 2005.

Dispatched students attempted to develop their expertise and broaden their perspectives through seminars and symposia held at ETH Zurich, while they advanced their own research by collaborating with foreign researchers as scheduled.

A symposium entitled "So, you've got a Ph.D. What's next?", in which Ph.D.s who play active parts in industry introduced their own career paths, provided good opportunities for the students to recognize the difference between the positioning of Ph.D.s in European industry and that in Japanese industry and to reconsider their own career paths. In the closing days of the period in Zurich, a joint symposium with researchers and faculty members at ETH Zurich was held, and the Japanese students presented their achievements during the month.

Although this was the first trial, the dispatched students made research achievements and laid the groundwork for future collaboration. They created individual relationships with foreign researchers through their disparate discussions. It seems that these experiences increased their confidence. Students from ETH Zurich subsequently visited the University of Tokyo, and the interaction between students at the two bases has been growing. This program will be carried out continuously after the next fiscal year.



In the laboratory

Cross-Department Doctoral Course

~Research Assistant Final Debrief Session~

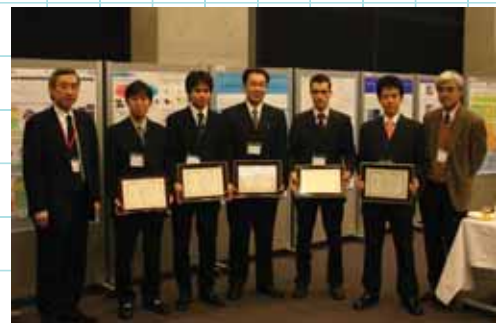
Date: January 27, 2006 Venue: Takeda Hall, Takeda Building, Asano campus

In a Cross-Department Doctoral Course lecture called "Mechanical Systems Innovation", a main axis of the graduate school education in this COE Program, research assistants (RAs) gather from seven relevant departments and divide into groups. In each group, RAs cooperatively find engineering problems in society, formulate them, and propose solutions to them. Through this process, we aim to cultivate the project management skills and leadership abilities of RAs. In this fiscal year, 30 RAs were divided into seven groups and have collaborated with each other.

As a conclusion to the lecture, the Research Assistant Final Debrief Session was held on January 27, 2006. Business promotion members from 10 major companies, 21 COE project promoters, Postdocs and RAs attended English oral and poster sessions given by each group. "Development of a Low Cost Aerial Photography System" was selected for the highest award, "Investigation of a Functional Fluid Applied to Medical Technology" for the design prize, and "Translation from Technical Knowledge to General Knowledge" for the idea prize, respectively.

The visitors from industries esteemed the originality of the themes and English presentations and gave RAs valuable advice on how to manage projects.

The wide acquaintances established during this activity will be of great value to the RAs in their graduate school lives.



Members of "Development of a Low Cost Aerial Photography System", which won the highest award. Prof. Kasagi, 21COE program leader (on the left) and Prof. Sakai (on the right)

Voices from Young Researchers

Junichi Kazawa, Post Doctoral Fellow,
Department of Aeronautics and Astronautics, School of Engineering



My name is Junichi Kazawa. I assumed the position of Post Doctoral Fellow in the 21st Century COE Program beginning October, 2004.

I am analyzing unsteady aerodynamic phenomena and its control in a gas turbine. In the compressor of a gas turbine, dangerous phenomena occur that can destroy the gas turbine such as surge, rotating stall, and cascade flutter. The compressor designed in the most efficient way could avoid these phenomena. Therefore, a more efficient and better controlled gas turbine can be expected to come through an investigation of such unsteady aerodynamic phenomena.

Recently, research on the micro gas turbine (MGT) has been performed actively with the purpose of using the MGT as distributed power sources. It is known that the efficiency of the compressor and turbine decreases when the Reynolds number is low in the MGT. Many fruitful studies on the mechanism of the decrease in efficiency have been reported, but unsteady aerodynamic phenomena in the MGT have not been much researched. I'd like to analyze the mechanism of these unsteady aerodynamic phenomena and investigate the possibility of their control when the Reynolds number is low. Your continued support will be greatly appreciated.

Kang Yi, Post Doctoral Fellow,
Department of Quantum Engineering , School of Engineering



My name is Yi KANG. I am Chinese and come from Beijing. I received my Ph.D. in the Department of Quantum Engineering and Systems Science in September 2004. I was then hired as a PD by the 21st Century COE program on "Mechanical Systems Innovation" on Oct. 26, 2004.

My interest is in energy. Energy demand due to increases in population and living standards will continue to grow. New energy technologies will therefore be required on a massive scale. Climate-change considerations make this need more acute. Fusion and hydrogen energy are the possible alternative technologies that can likely be

implemented on a massive scale.

In my doctoral course, I investigated tritium behaviors in the liquid Li-Sn alloy, which is a candidate material for a tritium breeder in the liquid blanket of fusion reactors. The tritium properties in this material show that it has some advantages in reducing tritium leakage to the environment and increasing tritium recovery efficiency compared with the present liquid breeder candidates (such as Li, Li-Pb, and FLiBe). I have investigated the material from the perspective of its tritium behavior and have determined that its application to a complicated fusion environment requires a more thorough and detailed investigation. I also at present am interested in hydrogen energy. The catalyst-membrane interface and mass transport in the membrane electrode assembly (MEA) of a fuel cell remains a new and challenging topic for me.

The 21st Century COE program on "Mechanical systems innovation" is a program that provides a good platform for communication and research collaboration among groups or people from different fields. I think that not only myself but many people will find a wide and interesting world here.

Project Promoters

Program leader

Nobuhide Kasagi
Professor, Department of Mechanical Engineering, School of Engineering

Energy innovation

Masahiro Shoji
Professor Emeritus, Department of Mechanical Engineering, School of Engineering
Toshio Nagashima
Professor, Department of Aeronautics and Astronautics, School of Engineering
Chisachi Kato
Professor, Department of Human and Society, Institute of Industrial Science
Takayuki Terai
Professor, Department of Nuclear Engineering and Management, School of Engineering
Kazuo Kageyama
Professor, Department of Environmental and Ocean Engineering, School of Engineering
Nobuo Takeda
Professor, Department of Advanced Energy, School of Frontier Sciences
Tamaki Ura
Professor, Department of Environmental and Ocean Engineering, Institute of Industrial Science
Shinichi Nakasuka
Professor, Department of Aeronautics and Astronautics, School of Engineering
Toyoshisa Fujita
Professor, Department of Geosystem Engineering, School of Engineering
Shigehiko Kaneko
Professor, Department of Mechanical Engineering, School of Engineering

Project members

Toshiki Iino Project Professor, International Research and Education Center for Mechanical Systems Innovation, School of Engineering
Yosuke Hasegawa Project Research Associate, International Research and Education Center for Mechanical Systems Innovation, School of Engineering

Advisory Committee

Advisory Committee

Koutaro Inoue Senior Fellow, Japan Science and Technology Agency
Noboru Kikuchi Professor, The University of Michigan

Biomedical innovation

Mamoru Mitsuishi
Professor, Department of Engineering Synthesis, School of Engineering
Masao Washizu
Professor, Department of Mechanical Engineering, School of Engineering
Masayuki Nakao
Professor, Department of Engineering Synthesis, School of Engineering
Teruo Fujii
Associate Professor, Department of Environmental and Ocean Engineering, Institute of Industrial Science
Takashi Ushida
Professor, Department of Mechanical Engineering, School of Engineering

Hyper modeling / simulation

Yoichiro Matsumoto
Professor, Department of Mechanical Engineering, School of Engineering
Takafumi Fujita
Professor, Department of Information and System, Institute of Industrial Science
Hideaki Miyata
Professor, Department of Environmental and Ocean Engineering, School of Engineering
Shinsuke Sakai
Professor, Department of Mechanical Engineering, School of Engineering
Shinobu Yoshimura
Professor, Department of Quantum Engineering and Systems Science

Yoshitsugu Kimura Professor Emeritus, The University of Tokyo
Tetsuya Tateishi Fellow, National Institute for Material Science

Activities of Mechanical Systems Innovation Program (scheduled)

<Open Seminars>

◎FY2005-14th Seminar

Date : November 15, 2005
Venue : Lecture Room No.226, Faculty of Engineering Bldg.8, Hongo Campus
Subject : Modelling Urban Air Quality
Speaker : Prof. R.J. Perkins (Laboratoire de Mecanique des Fluides et d'Acoustique Ecole Centrale de Lyon)

◎FY2005-15th Seminar

Date : November 10, 2005
Venue : Seminar Room A, Faculty of Engineering Bldg.6, Hongo Campus
Subject : Research Activities in AeroMEMS Laboratory
Speaker : Prof. Yong-Hyup Kim (School of Mechanical and Aerospace Engineering, Seoul National University)
Subject : The Research Activities of Institute of Dynamics and Control, School of Aerospace
Speaker : Dr. Baoyin Hexi (Assistant Professor School of Aerospace, Tsinghua University)

◎FY2005-16th Seminar

Date : December 20, 2005
Venue : Lecture Room No.226, Faculty of Engineering Bldg.8, Hongo Campus
Subject : Spectroscopy of Single-Walled Carbon Nanotubes
Speaker : Junichiro Kono (Associate Professor of Electrical and Computer Engineering, Rice University)

◎Special Lecture

Date : September 7 - December 14, 2005
Venue : Lecture Room No.84, Faculty of Engineering Bldg.8, Hongo Campus
Subject : Multiscale Modeling and Simulation
Speaker : Dr. Petros Koumoutsakos (Professor of Computational Science, ETH Zurich) Lawrence Berkeley National Laboratory)

<Industry-Faculty Council for Human Resource Development>

◎FY2005-1st Executive Meeting

Date : July 19, 2005
Venue : Lecture Room No.226, Faculty of Engineering Bldg.8, Hongo Campus

◎FY2005-1st Academic-Industrial Alliance Education Working Group Meeting

◎FY2005-1st Intramural Education Working Group Meeting

Date : August 24, 2005
Venue : Sanjyo Conference Gall, Hongo Campus

◎FY2005-2nd Industry-Faculty Council for Human Resource Development

Date : September 9, 2005
Venue : Lecture Room No.226, Faculty of Engineering Bldg.8, Hongo Campus

◎FY2005-2nd Intramural Education Working Group Meeting

Date : October 5, 2005
Venue : Lecture Room No.226, Faculty of Engineering Bldg.8, Hongo Campus

◎FY2005-2nd Academic-Industrial Alliance Education Working Group Meeting

Date : October 11, 2005
Venue : Lecture Room No.226, Faculty of Engineering Bldg.8, Hongo Campus

◎FY2005-3rd Academic-Industrial Alliance Education Working Group & Intramural Education Working Group Meeting

Date : November 22, 2005
Venue : Lecture Room No.226, Faculty of Engineering Bldg.8, Hongo Campus

◎FY2005-3rd Industry-Faculty Council for Human Resource Development

Date : December 14, 2005
Venue : Lecture Room No.226, Faculty of Engineering Bldg.8, Hongo Campus

<Cross-Department Doctoral Course>

◎Research Assistant Final Debrief Session

Date : January 27, 2006
Venue : Takeda Hall, Takeda Building, Asano Campus