



Newsletter

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

Mechanical Systems Innovation Special Issue on Human Resource Development 2006



“Mechanical Systems Innovation” promoter
Professor **Shinsuke Sakai**
The Department of Mechanical Engineering

Introduction

One of the vital pillars of our COE project is human resource development (HRD) related activities. Already, ‘Industry-Faculty Council for HRD’, ‘Industry-Academia-Government Interaction meeting for HRD’ and ‘Cross-Department Doctoral Course’ have been introduced in special issue Newsletter No. 9 as 3 major activities. In this issue, we will take a look at the results reaped through these activities.

First of all, it has been pointed out that regular inter-industry dispatching and exchanges of research assistants (RAs), i.e., Ph.D. students through internship as an exit in the former 2 activities are important. For this reason, an internship program for RAs was begun this year as a full-year lecture. While we cannot see the results of such activity immediately, as far as the reports presented at the Final Results Debriefing Session indicate, it has been greatly stimulating for both the students and the industry. There were constant trials and errors when the Cross-Department PBL Lecture first started, but thanks to the continued feedback obtained through questionnaires to find out the opinions of the students, the lecture contents have been improved and students better satisfied. For example, we now hear often of students proactively going out to enterprises or regional areas, and how they are now showing positive actions in investigations and collaborations.

In this way, I believe the HRD activities are steadily paying off. This newsletter will take a look at the accomplishments related to HRD achieved so far.

The “Mechanical Systems Innovation” Cross-Department Doctoral Course 2006

“Mechanical Systems Innovation I” : Cross-Department PBL Lecture

The Cross-Department PBL lecture “Mechanical Systems Innovation I”, which is the foundation of graduate school education within this COE program, receives 26 RAs this year and is divided into classes groups with ‘Health’ and ‘Environment’ stances, with a year-long collaboration of investigations and research.

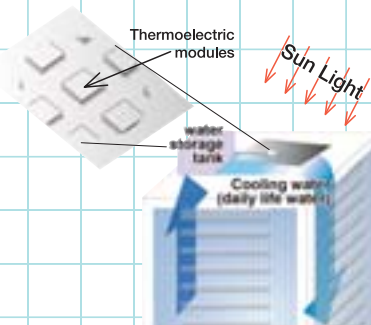
Furthermore, the group related to ‘Health’ is based on three separate themes: ‘Novel hiyari-hatto (Heinrich's law) definition for tailor-made accident prevention in everyday life’, ‘Application of Functional Fluid to Microfluidic Device’, and ‘The Use of the Functional Fluid Material as the Cell Culture Medium’. On the other hand, the group related to ‘Environment’ is divided into these study topics: ‘Aerial Monitoring System For Prompt Rescue Operations During Earthquakes’, ‘Proposal for an effective utilization system of rice residual in Japan’, and ‘Effective utilization system for unused energy sources -Power generation using heat-island thermal energy-’, with particular activities carried out accordingly.

For the lecture itself, we have had group discussions, lectures by key figures from the industry related to each of the themes, as well as lectures on project management and making presentations in English. Many groups have clearly shown their proactive activities in exchanging opinions with external enterprises and research institutes, and presenting their research results at related academic conferences.

Such results were presented in English at the year-end joint final results debriefing session.



Novel hiyari-hatto (Heinrich's law) definition for tailor-made accident prevention in everyday life



Effective utilization system for unused energy sources



The Use of the Functional Fluid Material as the Cell Culture Medium

“Mechanical Systems Innovation II” : Ph.D. Internship Program

As part of the Cross-Department Doctoral Course, an Internship Program was created and begun this academic year, for the purpose of cultivating qualifications in an industry-academy environment that would otherwise be impossible with academic efforts alone. This program aims to induce Ph.D. students to not only acquire knowledge within the university, but also to examine their own research fields from the social and economic aspects, and be aware of contact with the society with wider vision. 8 RAs participated in this program under the cooperation from 5 private industrial companies and 1 national institution.

These RAs have gained confidence because the knowledge they have acquired at the university thus far proved to be useful at the companies. They also told us how they were impressed by the way research progresses and the cooperative system where they worked as interns, among other comments that demonstrate their satisfaction.

Such actual experience that students are usually not aware of within the university will be an invaluable experience. We, the COE program, anticipate that this internship program will help Ph.D. students to become leaders of the 21st century, both in the industry and the academic world, and lead the society along.

In addition, the Ph.D. students have also received high evaluations from their supervisors where they worked as interns, achieving as the liaison between private industrial companies and the University of Tokyo. The results of this program, with considerations given to ensure confidentiality of each of the personal experiences, were presented at the Cross-Department Doctoral Course Joint Final Results Debriefing Session.



Group photo with internship students, their academic supervisors and the supervisors where they worked as interns.

The 2006 ETH Overseas Exchange Program

The aim of this exchange program is to send RAs from this COE program to Eidgen sische Technische Hochschule (ETH) in Zurich for 2 months for the cultivation of their the international, planning and specialty skills through overseas research work.

2006 marks the second year of this exchange program, and as an aim to further the exchange, the period of dispatch was extended to 2 months from 1 month in 2005. Prior to the dispatch, 4 RAs were selected after interviews were conducted by the COE program in English, concerning the candidates' research plan in ETH. They were then asked to make ample preparations before being dispatched to conduct their research under the host professor they previously contacted, from September 30 to November 26, 2006.

During this period, the 4 RAs participated in ETH lectures, executed research plans they themselves had planned' and through the presentation of their results in ETH at academic conferences, they were able to experience a different research culture from that in Japan. After each RA reaped great results for their future career path, they finally finished the program. In addition, an "ETH-UT Exchange Program Joint Workshop" was held in the last week of the dispatch period together with ETH' s PhD students who visited the University of Tokyo in 2005.

By extending the dispatch period to 2 months this year, not only can we further the exchange and obtain evaluations from the host teaching staff of the RAs dispatched to their research laboratory, we can also anticipate much of the exchange program for the following year. After returning to Japan, the RAs jointly submitted papers to international conferences and returned ETH with funding other than our COE subsidy, showing proactive and continual exchanges. This program continues to establish the close educational research system shared between the University of Tokyo and ETH.



Group photo at the Joint Workshop

The 4th Industry-Academia-Government Interaction Meeting for HRD

Date : September 20, 2006

Venue : Lecture room No. 232, Building 2 of the Faculty of Engineering

This exchange session invited key figures from the industry, the government and academic institutes to give our teaching staff and Ph.D. students lectures on how graduate school education should be conducted. Following the first 3 sessions conducted last year, the 4th session this year invites alumni graduated from the 5 departments in this COE program and currently actively involved in the industry over a wide area, to come and exchange their direct opinions with our current RAs.

Having attended a similar exchange program organized by ETH last year under the name "So, you' ve a got Ph.D. What' s next ?", the RAs used that experience to plan and organize this exchange session.

After the introduction of each of the speakers, they answered questions they had received from the RAs beforehand, such as 'Why did you go on to the Ph.D. course?', 'What is different from having obtained a master degree?', 'What are the merits and demerits of obtaining a Ph.D. degree?' and so on. More questions and answers followed, with RAs asking many questions, and an active exchange of opinions on career path was carried out.

The confidence demonstrated by their predecessors now active in the industry has given the current RAs great encouragement, while allowing them to reconsider their own career path, and thus making this exchange an invaluable opportunity.



Ph.D. students introducing each of the speakers.



Speakers (alumni)

“Mechanical Systems Innovation I, II” joint Final Results Debriefing Session

On January 26th, 2007, the Final Results Debriefing Session was held on the 5th floor of the Takeda Bldg. The results were presented in the first session on “Cross-Department PBL Lecture” and the second session on the “Ph.D. Internship”.

Session 1 “Debriefing Session on the Results of the Cross-Department PBL Lecture”

Using posters and oral presentations, each group gave a presentation in English to an audience including the members promoting the COE program, PDs, RAs and 11 invited key figures from the industry. The Top Award was given to ‘Proposal for an effective utilization system of rice residual in Japan’, with the Design Award given to ‘Effective utilization system for unused energy sources -Power generation using heat-island thermal energy-’, while the Idea Award was given to ‘The Use of the Functional Fluid Material as the Cell Culture Medium’. Each group received high appraisal from guests from the industry on the uniqueness of their research and their presentation in English, while obtaining also valuable advice on how to continue with their own projects. Meanwhile, the one year allocated for completion of some research themes is too limited, and proposals to continue these research works by turning them into some kind of workable system were also given. This was indeed an extremely beneficial session for the PhD students also because they were able to obtain evaluation from the industry.



Greetings



Poster Session



Awards Ceremony (Top Award)

Session 2 “Debriefing Session on the Results of the Ph.D. Internship”

The internship program was carried out with the submission of research proposals with the understanding of each RA, the host enterprise and the academic supervisor. After the internship was terminated, each RA participating in the program gave a presentation on the result (without violating confidentiality) or experience of their internship at the final debriefing session. We received comments from host enterprises concerning our Ph.D. internship such as ‘We discovered a new phenomena thanks to the intern for pointing out matters concerning measurement accuracy, which we don’t really pay attention to. These results are useful when we report to the factories.’ On the other hand, it was also pointed out that the program ‘period is short, therefore it is impossible to have experience in the overall cycle of product development, and that there are problems concerning safety and information security’, and so on, calling for the need for measures in the future. We look forward to continuing this industry-university cooperation next year together with the cultivation of the human resource that can lead the future of Japan’s industry.



Presentation



The atmosphere of the session



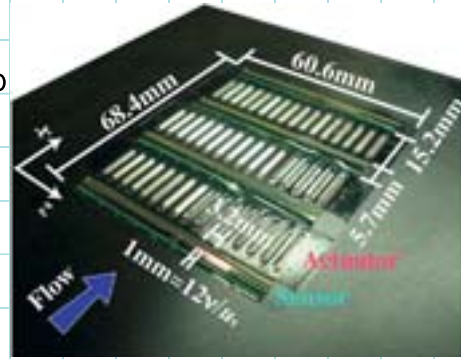
Panel discussion

Thermal and Fluid Engineering for Turbulence Control and Cell Separation

Professor **Nobuhide Kasagi**, Department of Mechanical Engineering School of Engineering, The University of Tokyo

●Developing future mechanical systems through simulation and experiment

I have been working in the field of thermal and fluids engineering since my university years. My advisor assigned me a research topic, in which I tried to make system designs by fully understanding fundamental processes of fluid flow and heat transfer of gas and liquid. I particularly concentrated my research on turbulence control, and aiming to actively control turbulence, I developed a numerical simulation method that can visualize the turbulence structures near a wall surface. I also developed a control unit by integrating micro wall shear stress sensors and shell-deformation-type electromagnetic actuator. They are lined up in a matrix state and created a feedback control system with a CPU controller. This unit was tested in a wind tunnel and was found effective for reducing the friction resistance of turbulence.



Overcoming turbulence, we are currently developing the decreasing control system in both hardware and software aspects. The photograph above shows the control device developed in our laboratory with a micro wall surface shear stress sensor and a wall surface shift type electro-magnetic actuator, a control system built using a controller.

As a project of the COE program I am now also involved in analysis and design of an energy system that can extract heat and electricity simultaneously using a hybrid system composed of a gas turbine and fuel cell. I am nearing the stage where the system may be just as powerful as modern thermal power plants.

I am also making a current effort in developing a micro cell sorting technology with the theory of fluid motion to sorting stem cells from blood. Capturing one unique stem cell out of 1 to 10 hundred million cells from the blood stream will become the basic technology for tissue engineering. Although there are already large-scale and costly systems available, only a limited number of people is benefiting from them. To that end, I am aiming to use the MEMS technology to create an efficient cell separation system on chips.

We are currently developing the control system for diminishing turbulence in both hardware and software aspects. The photograph above shows the control units developed in our laboratory with micro wall shear stress sensors, micro electromagnetic actuators, and a controller.

●Transdisciplinary discussions

Ever since I was little I have always liked making things. I would always wait for everyone in my family to finish eating the 'castella' sponge cake because I had wanted to make models out of the paulownia box that cased the cake, which was a luxury gift back then.

I entered the School of Engineering in university because I thought about doing something useful for the society. During my master course, I studied about heat transfer, but could not quite make up my mind as of what I wanted to do. Thereafter I continued on to the PhD course and later remained at the university as a full-time lecturer.

When I worked in Stanford University as visiting professor, I was surprised by the difference in the research facilities and the fact that specialists in physics, chemistry and aeronautics, researchers from NASA, and venture business people from the nearby Silicon Valley were entering and leaving the laboratory without any restrictions. It was there that I learned the importance of having transdisciplinary discussions. I still frequently discuss with researchers from the physics and chemistry fields. I hope that, in order to bring forth new creations based on the knowledge of dynamics, everyone in the COE program will work with people with different expertise.

I want to tell young researchers "While you are still young, take a more difficult path when you are lost." It is not about which way would help you gain more or which way would be easier, but to choose and challenge something more difficult, and never looking back once you make your mind. This is the privilege of young people.

I often get my inspirations for my research while walking from Hongo 3-chome station to my office in the mornings. It seems that the walking rhythm helps create ideas, though it also could be that the morning air makes the head fresh.

When I am stuck with my research, I would often go and have beer with my students, and we would have a brainstorm session. We vote for one person as clerk, who will not drink, while the rest of us come up with as many ideas we can, even if they are not realistic. When we examine these ideas in the following research meeting, we often find that many are actually executable. It was through this way that we were able to develop the method of measuring fluid velocity using imaging processing.

When I am in my office on Saturdays and work is slow, I would go out to pay respect to my father's grave in Yanaka before visiting an art museum in Ueno. I find it fascinating that reading about an artist after seeing his or her works can help us understand the thoughts and ideas of the artist in the paintings. When I have more time I would also like to go back to Suzumoto Engeijyo (comedy hall). I find the rakugo artists' speaking style is very useful for my own speaking style in my lectures. My wish is to continue giving self-satisfying lectures until my retirement from the University of Tokyo.



< Personal Background >

Dr. Eng. from the School of Engineering, the University of Tokyo in 1976. Appointed as Assistant Professor at School of Engineering in 1977. Worked as Visiting Professor at Stanford University in 1980-81 and became Professor at the School of Engineering in 1990. During 2002-2004, worked as Councilor at the University of Tokyo, and has been a member of the Science Council of Japan since 2005. Assumed posts as President of the Japan Society of Fluid Mechanics, Vice President of the Heat Transfer Society of Japan, President of Japan Society of Computational Fluid Dynamics, before assuming the post of President of the Japan Society for Mechanical Engineers since 2006. Also Member of the Royal Swedish Academy of Sciences and Leader of the 21st Century COE Program on Mechanical Systems Innovation at the University of Tokyo.

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

Project Promoters

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Hideaki Miyata
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Shinsuke Sakai
Professor, Department of Mechanical Engineering, School of Engineering
Shinobu Yoshimura
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Yosuke Hasegawa Project Research Associate, International Research and Education Center for Mechanical Systems Innovation, School of Engineering
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Advisory Committee

Advisory Committee

Koutaro Inoue Senior Fellow, Japan Science and Technology Agency
Noboru Kikuchi Professor, The University of Michigan
Yoshitsugu Kimura Professor Emeritus, The University of Tokyo
Tetsuya Tateishi Fellow, National Institute for Material Science

Activities of Mechanical Systems Innovation Program

<Open Seminars>

◎FY2006-7th Seminar

Date : Nov 2, 2006 10:30am-12:00am
Venue : Conference room 33B2, Faculty of Engineering Bldg.2, Hongo campus
Subject : Catalytically Active Nanostructures Derived from Self-Assembled Block Copolymer Templates for Rationally Synthesizing Single-Walled Carbon Nanotubes and Understanding the Growth Mechanism
Speaker : Dr. Jennifer Lu (Product development engineer, Microwave Technology Center, Agilent Technologies)

◎FY2006-8th Seminar

Date : Nov 27, 2006 2:45pm-4:25pm
Venue : Lecture room 72, Faculty of Engineering bldg.7, Hongo campus
Subject : Targeted Science R&D for Future
Speaker : Dr. CHOI Sang H. (NASA Langley research center)

◎FY2006-9th Seminar

Date : Dec 7, 2006 10:00am-11:00am
Venue : Lecture room 72, Faculty of Engineering bldg.7, Hongo campus
Subject : Composites and Fibre Optic Sensors
Speaker : Professor Alfredo Guemes

◎FY2006-10th Seminare

Date : Dec 7, 2006 11:00am-12:00pm
Venue : Lecture room 72, Faculty of Engineering bldg.7, Hongo campus
Subject : Structural Health Monitoring Studies at the French National Agency for Aerospace Research (ONERA)
Speaker : Dr. Daniel L. Balageas (ONERA)

<International Symposium>

◎International Symposium on Structural Reliability in Energy Systems Innovation

Dates : November 22, 2006
Venue : Yayoi Auditorium Ichijo Hall, The University of Tokyo

◎The 3rd International Symposium on Innovative Aerial/Space Flyer Systems

Dates : November 24~25, 2006
Venue : Takeda conference hall, Takeda bldg., Asano campus

◎The 3rd International Symposium on Biomedical Systems Innovation

Date : November 27~28, 2006
Venue : Takeda conference hall, Takeda bldg., Asano campus

<Workshops>

◎Energy Innovation Workshop

Date : Dec 6, 2006
Venue : Lecture room 232, Faculty of Engineering Bldg.2, Hongo campus
Speaker : Dr. Katsuyuki Osawa (Professor, Tottori University)
Dr. Katsunori Hanamura (Professor, Tokyo Institute of Technology)
Dr. Shigeo Hatamiya (Hitachi Co. Ltd)