The Superintendent of Naval Postgraduate School, Rear Admiral Chaplin has appointed Prof Lui Pao Chuen as Senior Fellow. It is a rare honour for Singapore as the Naval Postgraduate School had only made one such award in its history of 90 years.

Prof Lui Pao Chuen is best known as the Chief Defence Scientist, Ministry of Defence (MINDEF). He was appointed to then newly created post in 1986 and has held this appointment since. But he is closely associated with Faculty of Engineering and Department of Industrial and Systems Engineering in NUS - Prof Lui has been an adjunct professor with Department since 1990. His contribution to the research in the department deserves special mention.

He was very supportive of the formal establishment of the Systems Modelling and Analysis Laboratory in the ISE Department for multi-disciplinary research on systems engineering in 1996 through a research collaboration agreement between NUS and MINDEF. Since then a number of projects with MINDEF have been completed. This collaboration has also led to the completion of a number of post-graduate and final year theses.

Other than managing and being involved in a number of projects, every academic year Prof Lui gives three specialised seminars presenting some application of research results with direct impact in Singapore. This also serves as a bridge between the teaching and research that is very important. Drawing upon his years of experience in the engineering of large scale systems in Mindef as well as other Ministries, statutory boards and Government Agencies Prof Lui has helped developed and taught Large-Scale Systems Engineering in the department’s graduate program. The response from graduate students including those from other engineering departments and those from the management of technology program has been overwhelming.

Prof Lui graduated from the University of Singapore. He also holds a MSc from Naval Postgraduate School in USA; he was awarded the first MINDEF fellowship for postgraduate education. He started his career as a scientific officer with the UK Science Research Council before joining the Ministry of Defence (MINDEF) in 1966 as the Officer-in-Charge of Tests, Evaluation and Acceptance Section, on a short service commission as Captain. He identified the need for the Technical Department in the Logistics Division to provide technical support for acquisition of equipment for the newly formed Singapore Armed Forces and for their subsequent maintenance, and was given the opportunity to build-up this organization from scratch.

In 1975, he was appointed Special Projects Director and was responsible for the planning, system engineering and management of the implementation of major weapon systems for the SAF. He was promoted to the rank of Colonel in 1978. In 1984, he was appointed acting Director, Joint Operations and Plans
ISE Research Highlights

Human Factors Research into the Effectiveness of Retroreflective Tape

Reported by Alfred Seet Wai Keong

In 1998, 31% of all traffic accidents in Singapore occurred between the hours of 8 pm to 7 am. This percentage is significant considering the fact that there are fewer cars on the road at night during these hours. Although the roads in Singapore are well-lit, driving at night still poses many risks. Even with streetlights, the perception of vehicle speed and judgment of distance is compromised. Stationary vehicles parked along the road also pose risks to drivers. Furthermore, people tend to drive at higher speeds at night because the roads are clearer.

Large commercial vehicles such as lorries and trailers pose an extra risk at night because of their size. Because these vehicles are long, their edges are darker and less defined than automobiles. Accidents are also more likely to result in serious injuries and fatalities because of their larger mass. In order to improve road safety at night, a system of mounting retroreflective tape onto such vehicles has been proposed by our department senior lecturer, Dr Tan Kay Chuan. He is working with Masters Student Alfred Seet to research the effectiveness of using such tape on commercial vehicles of Singapore.

They will be conducting a literature review of such tape, particularly in the United States and the Europe where it has been utilized since the early 1990s. The human factors issues of using such tape will be studied in experiments with human subjects. There are several factors to consider, including the colour, pattern, location of markings and amount of tape to use. The costs and benefits of installing such tape is also of substantial importance, particularly to the owners of these vehicles. The project will attempt to come up with a proposal for instituting the tape in a Singapore environment. The project is ongoing at the moment and has been publicised in the Straits Times on the 15th of May 2000. Below are two photographs showing the rear of a truck before and after it has been marked.

Before Marking  After Marking

Directorate of the Ministry of Defence. In 1986 he was made Senior Director to set up the Defence Material Organization through the merger of the Material Management Organization and the Special Projects Organization.

Other than Adjunct Professorship at the Department of Industrial and Systems Engineering, currently he is on the management boards of several research institutes and corporations. Among these, he is Chairman of DSO National Laboratories from Jul 98, Chairman, Tropical Marine Science Institute (TMSI) from Jun 96, Director, Singapore Technologies Engineering Ltd from Oct 97, Member, Board of Governors, SAFTI Military Institute from July 1994, Member, Board of Directors, Defence Science and technology Agency 15 Mar 2000, Founding Chairman of ST Dynamics from April 2000. He was on the board of directors of various Government-linked-companies and Government agencies such as Director and Chairman of Singapore Electronic & Engineering Pte Ltd, Director of Singapore Aerospace Ltd, Founding Chairman of Chartered Engineering Pte Ltd, Director and Founding Chairman of Singapore Engineering Software Pte Ltd, Director of Chartered Industries of Singapore and Board Member of Land Transport Authority (LTA).

His unstinting efforts and brilliant contributions have been recognised by the many awards he received. He was the recipient of SAF Good Service Medal in 1975, The Public Administration Medal (Silver) in 1979, The Public Administration Medal (Gold) in 1992. In 1994, he was conferred the title Commander of the Royal Order of the Polar Star by the King of Swedish - an award given for his efforts in promoting defence co-operation between Singapore and Sweden.

Prof Lui plays tennis and golf and swims for exercise and is still learning downhill skiing intermediate “Blue” slopes.
This is our first ever ‘exclusive appearance’ on ISE newsletters; we are indeed honored and excited!

First, we would be pleased to present to you excerpts from an interview with our Coordinator, Dr. Lee, who had started this group and guided us thus far. He started the group in July 1998, with only four students, namely Joe, Keng Huat, Michael and Yingli. Among them, Joe has gone into the industry; the others would be joining him soon. Three of them have kindly agreed to contribute an article each, which are printed after excerpts from the interview.

**Q: What are the goals/objectives you have in mind when you first started ORG?**

**A:** My initial objective was to create an environment conducive to the generation of new ideas in the various research areas that the students were working on. In other world-class universities, there are research groups comprising of students under the directions of some academic advisors, who help to stimulate ideas and clarify doubts through the group discussions. I would like to establish such a culture amongst the students here too, through the set up of ORG.

**Q: How far do you think these objectives have been met?**

**A:** We have managed to create an atmosphere of friendly discussions whether formally or informally. Through regular student research presentations, I believe that the postgraduates have gained both experience in presentations and a clearer understanding of their work. Moreover, the discussions that follow, not only stimulated ideas in the individual research areas that the students were pursuing, but such a grouping of students doing research in different areas also created opportunities for the cross-fertilization of ideas amongst the different fields.

Apart from work, we have various social and recreational activities together, which helped to foster stronger relationships among the students. As a result, I think we have successfully created a tightly knit community, where an atmosphere for friendly debate, always exists.

**Q: What are your future plans for ORG?**

**A:** That besides maintaining the valuable learning environment created, we must continue to strive on improving and achieving higher standards. It is also important for us to maintain an archive of the presentations and projects done in the past, so that such valuable information would not be lost to the future generations of ORG.

**Thoughts**

I came to Singapore from China in July 1998 as a research scholar under ISE department in NUS. I was working on the research project about Genetic Algorithms, with Dr Lee as my supervisor. At that time, Dr Lee was also planning to establish a study group to study the various methods of optimisation and to find ways to implement these methods on a more practical level. So he invited me to join the ORG and participate in the activities.

Having just come to Singapore for the first time, everything was new to me. Besides, I did not know many people here.
Fortunately, the local students in ORG are very friendly. During the first few weeks of my arrival, they brought me around Singapore, introduced the local customs and delicious local food to me. In exchange, I told them a lot of interesting things about China. We got along very well and built up strong friendships with one another.

Other than making me feel at home in Singapore, ORG also provided an excellent outlet for me to learn and discuss various interesting research topics about optimisation. At first, we had a series of presentations on topics given to us by Dr Lee. Through such presentations, I got to know fuzzy logic, neural network and other useful areas of research interest. Moreover, those presentations helped me improve my language and presentation skills. Later, we took turns to present our individual research projects and discussed with the group several problems we faced in our research. The discussions gave us an opportunity to learn and help one another in our research. Our individual supervisors also came down to guide us with several pointers in some sessions.

On the whole, I learned a lot from ORG and I believe this knowledge would benefit me not only in my current research, but also in my future work. Thank you, ORG.

Industrial Engineer

and the semi-con industry

Chen Soon Cheez, Joe

Industrial Engineering has a major role in the semi-con industry. Efficient and effective management of a fab has been proven to be tough as semi-con manufacturing is one of the most complicated production environments.

Its complexity can be attributed to the following:-

- Cyclic processes with products to share the same floor space and equipment.
- Long cycle times propagate yield issues.
- Variant batching makes it difficult to manage the work in process (WIP) and to create an effective scheduling mechanism.
- Expensive and sensitive equipment complicates installation and layout changes.
- Clean room environment introduces layout and operational constraints.

Hence, effective scheduling is a great challenge. Currently working in the planning section of a wafer fab, my role is to manage the startup of new generation (0.15 micron) DRAM.

The current product lifecycle of DRAM is about 2 years, and the expected time window from first start to ramp up usually takes up to 1 year. This highlights the importance of efficient startup management. Initial production performance (startup phase) has been enhanced with support through model implementation, scheduling and work procedures.
People

New MEng/PhD Students

We would like to welcome the following research students to our department:

1. Mr He Bin from University of Science & Technology of China
2. Mr Li Wei from Shanghai Jiaotong University
3. Mr Lisman Komaladi from University of New South Wales
4. Miss Mok Tsuey Wei, Ivy from University of Oklahoma
5. Mr Ng Kee Wee from National University of Singapore
6. Mr Ng Tsan Sheng from National University of Singapore
7. Ms Pan Xiajun from Xi'an Jiaotong University
8. Mr Sim Mong Soon from National University of Singapore
9. Ms Theresia Amelia Pawitra from National University of Singapore
10. Miss Yang Guiyu from Xi'an Jiaotong University

Recent Graduates 2000

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<tr>
<th>Name</th>
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<th>Thesis Title</th>
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<tr>
<td>Mr Tan Aik Peng</td>
<td>MEng</td>
<td>Planning and Analysis of Constant Stress Accelerated Life Test</td>
</tr>
<tr>
<td>Mr Zhang Fuqiang</td>
<td>MEng</td>
<td>Index Decomposition Methodology with Application to Energy and Industrial Systems Studies</td>
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Optimization targets to answer questions such as:-

1. How much capital to inject?
2. How much production capacity gain?
3. How much investment would yield the best ROI?
4. What is stopping us from doing more?
5. When can we start loading?
6. What is stopping us from loading earlier?
7. When can we do a full ramp?
8. What is stopping us from ramping earlier?

Current situation is such that long equipment delivery and facility setup lead time (usually 6 to 12 months after placing order) result in capital and capacity planning to start work as early as 15 months before loading the first new product into the line. Simulation has been used (since actual infrastructure may not be available then) to mimic both macro (production steps) and micro (process recipe) aspects of the fabrication process and optimization techniques such as goal softening has been widely employed.

In the light of rapid technological advancement, the importance of IE has increased with shorter product lifecycle. The US semi-con industry in particular has realized that to remain competitive globally, it must lead not only in product development, but also in manufacturing. IE techniques have been proven to offer one of the most effective strategies for achieving such manufacturing excellence.

Graphics Awards

ISE-ORG website (1999-2000) created and developed by Michael Tan Mien Duan has won the following awards for having a great Website Design.

- Best of the Web 2000 Silver Award
- Jeff Hobrath Art Studio Web Award
- The Millennium Design Silver Award
- The Manor Plaque of Web Excellence
- The Jeffrey’s Excellent Homepage Gold Award
- The Otakou Creative Design Gold Award
- The Magic Automatic Diamond Award
- The Silver Surfer Gold Award
- The Critical Mass Award
- Blazen’s Web Creation Award
- The Art Force Award
- The Golden Web Award

Details can be found on the ORG Award web-section at: http://www.isc.nus.edu.sg/org


