外部評価報告書

―外国人研究者による評価―

2003年7月

岡山大学工学部自己評価委員会

はじめに

組織の健全な発展のためには自身を常に見直す機能を組み込んでおくことが必要である。特に，外からの点検・評価は重要である。工学部においては，平成１０年に国内大学人，平成１１年に国内企業人および圏外研究者による外部評価を実施し，教育，研究，社会貢献のそれぞれの面について評価・提言を受け，学部・学科の運営に活かしてきた。また，地域を中心とする企業の技術者の方々には工学部工学教育評価外部委員会を構成していただき，助言をいただいている。平成１４年度に工学部３学科が日本技術者教育認定機構(JABEE)の審査を受け，認定されたが，この結果に至るには，以上のような外部評価に基づく教育改革が大きく寄与している。

この度，平成１４年度大学改革推進等経費の配分を受けて，これまで国外の研究者による評価を実施していなかった３学科について，外国の有力な研究者を招いて外部評価を行うことができた。その結果，この報告書にあるとおり，外部評価者からは概して良好な評価とともにいくつかのご指摘をいただいた。

個々の研究室，あるいは研究者の研究水準は，ほとんどの場合，国際的な基準からみて十分高く，大学院学生も研究活動に積極的に参加していると評価された。一方で、博士課程の学生数，修了年限，教員による起業，あるいは研究室または研究室の集合としての研究の方向についての指摘もあった。教育についても高い評価を得ているが，分散配置されている１学科の状況改善などを指摘された。学科経営では，学科長としてのリーダーシップの学科教授による共有について賛否双方の意見をいただいた。

研究・教育および社会貢献のスタイルは歴史的経緯により、国，あるいは機関ごとに大きく異なる。短期間の滞在であっても研究にかかわると，暗黙の仮定が（日本とは異なることを十分承知した土での）予想と異なる経験がどなたにもあるであろう。この度のような複数の外国人硯発着の視点は暗黙の了解から自由に考え，発想を転換する上で大変貴重である。制度の制約，組織の慣性があり,また,提言をすべて無条件に受け入れるべきでもないとは思われるが,今後の工学部の指針を立てる上で多いに役立つことは間違いない。

３人の評価者の方々には，外部評価を快く引き受けていただき，極めてご多忙であるにもかかわらず実地調査に来日し，短期間に的確な報告をまとめていただきました。また，外部評価の実施にあたっては多くの方々のご支援をいただきました。ここに改めて深く感謝いたします。

平成１５年７月

岡山大学工学部長　東　辻　浩　夫

岡山大学工学部　外部評価報告書

－ 外 国 人 研 究 者 に よ る 評 価 －

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Ⅰ　外部評価者一覧

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学　　科	外 部 評 価 者	評 価 実 施 日 程
電 気 電 子 工 学 科	トロント大学(カナダ) 教授 Adalbert Konrad(ｱﾀﾞﾙﾊﾞｰﾄ ｺﾝﾗｯﾄﾞ)	平成１５年2月２０日～２２日
生 物 機 能 工 学 科	デルフト工科大学(オランダ) 名誉教授 Johannis A. Duine (ﾖﾊﾆｽ A. ﾀﾞｲﾅ)	平成１５年3月１４日・ １７日～２０日
通信ﾈｯﾄﾜｰｸ工学科	カリフォルニア大学(米国) サンタバーバラ校 教　授 Malgorzts Marek-Sadowska (ﾏﾙｺﾞｻﾞｰﾀ ﾏﾚｯｸｻﾄﾞｩｽｶ)	平成１５年2月１７日～１９日

Ⅱ　外部評価報告書

１　電気電子工学科

１　電気電子工学科

評 価 結 果 の 概 要 等

１４年度の予算申請の際に計画立案を行い、査定後決定した当該年度予算に基づき外国人研究者による外部評価を行った。査定後は一名のみとの制限が課されたため、電気電子工学科の高橋教授の紹介によるカナダ・トロント大学工学部教授である Adalbert Konrad 氏に依頼することとなり、快諾をいただいた。

Konrad 教授は、カナダ・モントリオールにある McGill 大学を 1970 年学部卒業、1971 年修士課程を修了し、1975 年に同大学において電気工学の Ph.D.を取得した。その後、客員研究員などを経て、1979 年よりニューヨーク・スケネクタディにある GE の Corporate Research and Development に勤務した。そこでは Eelectromagnetics Program に所属し、変圧器、モータ、セラミックの電子パッケージ、マイクロ波集積回路などにおける電磁気的な課題を有限要素法による数値解析によって解決する仕事に従事した。1990 年にトロント大学の電気工学科の助教授、1996 年に教授に昇任して現在に至っている。専門は、電磁デバイスの EMI 解析、電磁音響変換器の解析と最適化、非線形磁気回路解析、バイオ・インピーダンス診断法などである。　1995 年より IEEE フェローである。

評価作業としては、2003 年 2 月 17 日(月)事務手続、東辻浩夫学部長より外部評価者の任命、引き続いて書類審査を実施、視察を含む学科の教育および研究体織の評価作業は、２０（木)、２１（金)、２２（土）に行われた。学科の教育体制と研究体制を説明し意見を交わした後、視察をしていただき、報告書を執筆願った。

主な評価結果の概要は次のとおりである。まず、実践的研究が多く、装置を使った実験的研究の多いことが印象的であった。岡山大学のように、短年学科長がローテーションで代わるのは、すべての教授が均等に経験でき、意思決定の透明性が確保でき、良いモラルが持続できると評価できる。学科の講義のペースはカナダに比べて遅いように思われるが、（１５週という）セメスタの長さは評価でき乱また、電気電子工学科では、多くの修士課程学生がいるにもかかわらず博士課程学生は極端に少ない。これは修士課程が２年と長く、博士課程の３年と合わせると５年になり、これが進学意欲を削ぐと考えられる。これらの期限は規則上短縮が可能と理解するので、修士課程を工年半に短縮し、優秀な学生は修士・博士課程合わせて４年程度で修了できるようにして、樽士課程修了者を将来的に増やすことが望まれる。数人ではあるが学生へのインタビューをしたところ、研究に非常に強い興味を持ち、研究の進め方も良いセンスをもっており、院生の質は非常に高いと思われる。岡山大学の修

士課程の入試は効果的で、適切なレベルの院生を受入れる良い方法を採用していると思われる。まとめとしては、基礎及び応用面で大変質の高い研究をしていると評価できる。それは、それらの成果のほとんどが非常に堪能な英語で書かれた論文として世界的に有名な雑誌に掲載されていることからもわかる。また、教授から学生まで学科内全体が活気に満ち溢れているのに感銘を受けた。ただし、修士課程進学者の数が多いのはいいが、博士課程の人数が少ないのは問題である。規則を活用して、学部卒業後早い場合には４年で博士課程が修了できるよう配慮すべきである。トロント大学およびカナダの大学と比較して当学科で見受けられなかったものは、教官の兼業による起業や会社経営である。このような活動は教育の犠牲の上に成り立つので、必ずしも学生達の援助にはならないが、研究費の増加につながると期待できる。

Konrad 教授によって行われた評価に基づく指摘内容は当学科にとって改善すべき点を多く含み、その点は本訴極により得られた大きな成果であり、今後の取り組みに生かす方針である。またこれらに加えて、当学科において行われている教育やその体制に関する英語版の資料や、各研究分野の研究内容などに関する英語版の適切な紹介資料を作成したことは今後の学科の広報活動などに有用な資料となると思われる。また Konrad 教授によるトロント大学の教育・研究体制紹介の講演を通じて、スタッフや大学院生、学生が英語によるコミュニケーションの重要さを認識し、さらには学生・院生が例えばカナダに留学をする際にはどの程度の英語力が身に付いていれば入学が許可されるかなど、意識的に相当努力して調査しなければ得られないような貴重な情報が得られたことは副次的に得られた利点として大きな成果といえる。これらも今後の取り組みに生かして行く予定である。

評　価　結　果

External Review of the

Department of Electrical and Electronic Engineering

at Okayama University

by

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(see attached Short Biography)

February 2 1 , 2003

Introduction and Description of Events

On February 17, 2003, Professor Hiroo Totsuji, Dean of the Faculty of Engineering at Okayama University officially appointed me as an External Reviewer on research and educational activities in the Department of Electrical and Electronic Engineering. This report is a result of my visit and interaction with academic staff and students on February 20th and 2lst. I will give a brief description of the events of these two days in chronological order.

On Thursday, February 20, Professor Shigetoshi Nara, Chair of the Department of Electrical and Electronic Engineering, met me at 8:50 am. and took me first to the four-story building housing the Department and then to the Faculty of Engineering building.

At 9:30 a.m. I met with Dean Hiroo Totsuji who kindly described to me in some detail first the history and organization of the Faculty of Engineering and then the group structure of the Department of Electrical and Electronic Engineering. This gave me the necessary perspective on the place of the Department within the Faculty and also how the various components relate and interact with one another.

At 10:00 a.m. I had the pleasure of becoming acquainted with the professors of the department, who each gave a brief presentation on their group's objectives and research activities. This was very helpful for understanding the group structures and the manner in which research is carried out in the department.

In the afternoon, I was given a tour of six department labs, which are operated by the various groups within the department. I did not visit the Electric Power Laboratory and the Laboratory for 3D Electric and Magnetic Field Analysis since I had the occasion to visit them previously in 2002, 1998> 1996 and 1989.

The lab tours have been extremely useful from the point of view of observing both undergraduate and graduate students in their research activities. It also gave me the opportunity to discuss group and individual research projects with the professors, associate professors, lecturers and assistants. During the tours I requested and received copies of publications relevant to the research work being pursued by the groups. The lab tours and discussions with researchers took up the better part of the afternoon.

On Friday morning, February 21*t, I met Professors Takahashi and Fujiwara at 9:30 a.m. Professor Fujiwara helped me with the setup for my presentation that took place at 10 a.m. in another building. My presentation entitled A Brief Introduction to the University of Toronto was aimed at acquainting staff and graduate students with my university as well as giving them some idea of the certification and appraisal process of both undergraduate and graduate programs in the Province of Ontario. I was very pleased with the interest expressed by the audience.

In the afternoon, Professors Murase and Nogi explained to me how research is funded in Japanese national universities and the challenges lying ahead during the impending restructuring that will take place at Okayama University and other national universities in Japan during the next two years. The rest of the afternoon was spent on reading and reviewing some of the printed material I received.

Background and Experience Relevant to the Review

Although I never held an administrative position, I spent three years (1997-2000) as an Appraisals Committee member, and one year (1999/2000) as Appraisals Committee Chair with the Ontario Council on Graduate Studies. Therefore, I have intimate knowledge of the graduate program appraisal process for the 1 7 Ontario universities. In addition, since 1990, I have been teaching both graduate and undergraduate students and supervised many Master's and Ph.D. research projects in the Power Devices and Systems Group of the Department of Electrical and Computer Engineering at the University of Toronto.

Currently our department has about 3 1 assistant professors, 5 associate professors, 37 full professors, 2 university professors (the highest title a professor can have), 1 8 professors emeriti, 4 senior lecturers, 16 cross-appointed professors, and 22 adjunct professors. Of all the engineering professors 24 are IEEE Fellows. Presently the total number of full time electrical and computer engineering undergraduate students is 1425 (549 electrical and 876. computer engineering students). Our department also has a total of 393 full time graduate students in master's and doctoral programs.

Preparation for the Review

Prior to my visit to Okayama University I received several brochures and documents describing the University, the Faculty of Engineering, and the Department of Electrical and Electronic Engineering. I also received material describing the research groups and some sample publications.

Just before my trip, I visited the web sites of the Faculty and the Department. I was favorably impressed with the quality of the web sites and pleased to find English versions of the main web pages. I was somewhat disappointed that two or three labs do not have web pages and that most of the research group level web pages only have Japanese versions. However, this comment is not meant to be severe because, based on my own personal experience, I am fully aware how difficult it is to find the time to translate and maintain web pages.

In what follows in this review I attempt to make a comparison with Canadian universities in general and the University of Toronto in particular. By drawing attention to some of the fundamental differences I hope to provide an assessment from a broader perspective of the research and educational activities in the Department of Electrical and Electronic Engineering at Okayama University.

Comments on the Organization of the Department

My first impression of the organization of the Department was that it is very similar to the way North American universities subdivide their electrical engineering departments into research groups. However, the similarity ends here and I found the research groups to be quite different from what I have been accustomed to in Canada.

On the average, research groups in North American electrical engineering departments represent an administrative subdivision consisting of 3 to g professors, usually a mix of full, associate and assistant professors. These professors independently pursue their own research interests within a discipline and supervise several master's and Ph.D. students whose exact

numbers usually depend on the amount of research funding available to the professor. Undergraduate students are not involved in research. They are given a design project to work on in the final fourth year of study.

The mix of professors in a group must constitute a "critical mass" in the sense that the graduate courses taught by the group members adequately cover the mandated research area of the group. A periodic review of the graduate program every seven years assures that this critical mass exists.

At Okayama University, the groups are centered on one senior professor with two or three associates and about two-dozen research students including a large number of undergraduates. Apparently, all final-year undergraduate students are involved in research. I find this an intriguing idea and am convinced it has merits. It was amazing to watch undergraduates working on research projects side by side with master's students.

Since a group's research activities are centered on the research interest(s) of the senior professor in charge of the group, I found that many of the student research projects were very closely related. This is not always the case in Canadian universities where the graduate students of a professor may be working on a diversity of topics in a certain area. There is also the impression that most of the research work done by students at Okayama is the hands-on type and usually involves hardware and experimental work. Even projects, which are heavily computer-based, seem to require some knowledge of the real world. To me this appears to be a very healthy environment from the point of view that one of the objectives of master's and doctoral level research is the training of highly qualified personnel for industry. In North America it sometimes happens that the experience gained during the course of a master's program has little usefulness or even relevance to the needs of industry.

Comments on the Running of the Department

Having just experienced in my own Department of Electrical and Computer Engineering the consequences of a period of 10 years under the chairmanship of one person, I cannot help but to heartily endorse the practice at Okayama University of rotating the position of department chair among the senior professors on a yearly basis- The benefit of this practice is that all senior professors develop an interest and appreciation for the task of running the department and they all acquire the experience. This probably leads to transparency in decision-making and also helps to maintain good moral.

Teaching and Educational Activities

The first thing I noticed when looking through the brochures about the Department of Electrical and Electronic Engineering was a sharp decrease in the number of applicants and enrolled students during the past two or three years. However, I fully accept the explanation for this in terms of a faculty reorganization that resulted in the creation of a separate Communication Network Engineering Department in the year 2000. When this is taken into consideration, there appears to be no substantial decline in student enrollment.

It would have been of great interest to me to observe both graduate and undergraduate instruction at Okayama University. However, given the short duration and timing of my visit, this would have been impossible to arrange. Compared with Canadian universities, there is

the important difference in the length of the semesters. A semester in Canada consists of just l 3 weeks of intensive instructions. The academic year runs from September to April with virtually no courses being offered during the summer months (May through August).

My impression is that, in general, undergraduate class sizes are relatively small at Okayama University's Department of Electrical and Electronic Engineering and that the pace of lectures during a semester is slower than in Canadian universities. This is definitely to the advantage of both students and staff. Although it is hard to find proponents of lengthened semesters in Canada, I consider the comparatively longer semesters at Okayama University a positive aspect.

Degree Completion Times

The recommended completion time for an engineering master's degree in Ontario universities is 1 8 months. Some students may take longer to complete their master's degree requirements but there are also cases of some bright and eager graduate students who finish their courses and thesis in just 12 months. I supervised such a student during the past 5 years who is now an assistant professor at a reputable university in the United States. We also have what is referred to as a dual master's/doctoral registration for one semester which allows excellent and outstanding students to complete both a master's and a Ph.D. degree in a total of 4 years.

The number of master's students in the Department of Electrical and Electronic Engineering at Okayama University appears to be large in comparison with the number of doctoral students. Apparently, a master's degree takes, on the average, 24 months to complete. I find this to be long. It is possible that the prospect of spending 36 more months on a doctoral degree after spending 24 months on a master's degree is a disincentive for good students to enroll in a doctoral program. My interpretation of the rules and regulations governing degree completion times at Okayama University is that 2 years for a master's degree is not mandatory. Similarly, an additional 3 years for a doctoral degree is not a rigid requirement. If my interpretation is correct, this is something the department may wish to examine and exploit in the future in order to reduce the average number of months for completing a master's degree to approximately 1 8 months. Similarly, an outstanding master student continuing in the doctoral program should be able to graduate in approximately 4 years.

Quality of the Students and Admission Policies

The impression I have is that the quality of the graduate students being admitted is generally very good. The few students I talked with all seemed to be keenly interested and had a good sense of how their research work was progressing. Also, they all appeared to be happy with their supervisors. I would have liked to find out how thesis supervisors are chosen or assigned. However, whatever the process may be, it seems to be working,

There is a major difference in the admission process between Okayama University and Canadian universities. Canadian universities have no quotas on admission and there are no entrance examinations. Acceptance is based on the collective approval of all professors in a group rather than the personal desire of an individual professor to admit an applicant. Admission is heavily based on the academic record and references of applicants. Doctoral students must pass an oral or written qualifying exam during their first year in order to continue in the program. I am convinced that the entrance examinations at Okayama

University are a very effective and failsafe way to select acceptable graduate students. Admittedly, our admission process at the University of Toronto does occasionally lead to the acceptance of an applicant who is later found to be unsuitable.

Research Activities of the Groups and Quality of Publications

(1) Electrical Engineering

As mentioned. I visited the *Electric Power Laboratory* on previous occasions and had many discussions with Professor Norio Takahashi and Associate Professor Koji Fujiwara over the years. This is one of the most versatile and best run power labs in a university setting that I know. Power labs from most North American universities have disappeared during the past two decades and the University of Toronto is one of a handful that still has one. However, many years of under-funding have left it with obsolete equipment and limited capability for experimental research. Even university power labs I visited in France and Italy do not match the quality and versatility of Okayama University's Electric Power Laboratory.

Currently, there are 3 doctoral, 11 master, and 11 final-year undergraduate students working on research projects in this lab. Their research encompasses a range of experiments and measurements on electric machines and other power apparatus, as well as state-of-the-art modeling activities. The Laboratory for 3D Electric and Magnetic Field Analysis, where the results of field computation are readily subjected to experimental verification, is still unique in the world. The steady list of publications in IEEE Transactions on Magnetics and other archival quality journals by Professors Takahashi and Fujiwara has earned this group an excellent reputation worldwide for being able to model and experimentally verify some of the most difficult 3D eddy current problems.

My first visit in the afternoon of February 20th was in the *Electrical Machinery Laboratory* with Professor Satoru Murase. Assistant Professor Satoshi Ogasawara, and Research Assistant Nozomu Nanato. There are 8 graduate students and 11 final-year undergraduate students working on research projects in this lab, The activities of the group comprise two main areas: applied superconductivity and power electronics.

The applied superconductivity work is somewhat unique. I am not aware of any university facilities in Canada where undergraduate and graduate students have access to the kind of equipment I have seen in Professor Murase's lab to perform experiments in superconductivity. On the basis of Professor Murase's publications in top technical journals I can only conclude that his research is current and of excellent quality. Dr. Nanato's work on quench detection appears to be a continuation of experimental research carried out at Nagoya Institute of Technology prior to joining Prof. Murase's group not too long ago.

The research work on sensorless drives, power converters, and EMI/EMC is more or less what I expected to see in the area of power electronics and, to some extent, it mirrors the research activities of other university groups involved in power electronics. Professor Ogasawara's publications on EMI suppression in power electronic circuits, and the application of sensorless drive technology are indicative of very good quality research.

I was very much impressed with my visit to the *Electrical Measurements Laboratory* where I witnessed tremendous interest and enthusiasm by the 8 graduate and 12 undergraduate

students working there. Professor Masami Konishi, his assistant Dr. Tatsushi Nishi, and lecturer Dr. Jun Imai are doing an excellent job of generating interest and enthusiasm among the students. The demonstration of the decentralized wireless control of multiple mobile robots for transportation was fascinating to watch and I can understand its attractiveness to students. The demonstration of the stability control of an inverted pendulum was equally interesting. Judging from the publications I received from Professor Konishi's group, there is plenty of theoretical development behind these projects. Yet, I find the practicality of Professor Konishi's projects in sharp contrast with the highly theoretical research activities of the Systems and Control Group in our department at the University of Toronto. Professor Konishi's long industrial career and strong connection with industry is probably a key factor in the success of his group.

(2) Electronics Engineering

My next visit was in the *Electronic Circuits Laboratory* of Professor Shigeji Nogi, lecturer Dr. Minoru Sanagi, and assistant Dr. Kazuhiro Fujimori. The main thrust of the research work in this lab is in the area of microwave and millimeter-wave power dividers and combiners, miniature active phased array antennas, and smart antennas for future mobile communication applications.

As in the other labs, there is emphasis on experimentation in the curriculum for undergraduate students pertaining to this lab. In my opinion, this is the right approach. Students in this group are involved in all phases of the design, fabrication and testing of different microwave printed circuits. A number of such circuits were on display in the lab. Dr. Sanagi and several graduate students were eager to explain their functionality to me.

I found the lab display and a recent paper on the Fabry-Perot resonator-based power combiner very interesting. Professor Nogi and Dr. Sanagi have many years of experience related to this type of power combiner and they seem to be getting closer and closer to an optimum configuration. Similarly, I read their paper on a new phase-shifterless beam scanning technique for active antenna arrays with great interest and consider their work to be leading edge.

Research conducted in the *Materials Science Laboratory* by Professor Yoichi Kamiura, lecturer Dr. Yoshifumi Yamashita, assistant Dr. Takeshi Ishiyama and their I O graduate and 13 undergraduate students, is as much in the realm of solid-state physics as engineering. Therefore, it is not surprising that most of the published papers from this lab appear in top quality physics journals.

The goals of the lab are well defined and the research activities in it are very focused. Professor Kamiura gave an excellent presentation in which he outlined the research program of his lab and explained its importance to electronics, However, much of the experimental research work is on a microscopic level, and although Dr. Yamashita and the students were very helpful, it was difficult for me to visualize some of the activities while visiting this lab. I must admit this was the first time I have seen apparatus for deep-level transient spectroscopy. Upon reading a few of the recent publications from this group I developed an appreciation for the complexity of the phenomena being studied, Undoubtedly, the experimental work on the effects of hydrogen on impurities and defects in semiconductor materials is advancing the state of the art and addresses current needs of the semiconductor industry.

The *Laboratory of Physics for Electronics* of Professor and Dean Hiroo Totsuji, Associate Professor Kenji Tsuruta, and Research Associate Dr. Chieko Totsuji could also be appropriately called the Computational Materials Science Laboratory and it is the perfect complement to Professor Kamiura's experimental Materials Science Laboratory. There is even some congruence in the objectives of the two labs regarding the development and improvement of materials for the semiconductor industry,

I received 14 fairly recent sample publications, all in English. The majority of the papers are published in respected physics journals. They cover interesting topics ranging from large-scale simulations in plasmas to molecular dynamics studies on nanocrystalline ceramics and diamond. The publications are indicative of a very active group. There are currently 8 or 9 graduate and 11 undergraduate students working on various projects in this lab. During my visit to the lab both Dr. Tsuruta and Dr. Chieko displayed a great deal of enthusiasm towards their research and provided me with clear explanations of ongoing projects. Dr. Tsuruta showed me a large-scale numerical simulation of Coulomb interactions running parallel on PC clusters located in the lab. According to a recent IEEE publication co-authored by Dr. Tsuruta, parallel computations are also performed with distributed PC clusters located at other universities in Japan and in the United States. This is quite advanced compared to what I have seen in Canada.

The *Intelligent Device Engineering Laboratory* of Professor and Chair Shigetoshi Nara, Associate Professor Tomoyuki Nagaya, and Research Associate Dr. Takeshi Nishikawa appears to be a relatively recent addition to the department. I like the novelty of the idea behind the creation of such a lab within the Department of Electrical and Electronic Engineering. However, judging from what I have seen in the lab and the sample of papers I received, more effort and resources are required to bring the research activities of this lab into focus .

Professor Nara's work on the behavior of large chaotic systems, cellular automata and its application to data compression are very original. Dr. Nagaya's research work involving liquid crystals is strongly physics-based, internationally collaborative, and leading edge. In the lab he has shown me a demonstration of controlled electro-hydrodynamic convection in a liquid crystal, which was very interesting. However, his research may be more closely related to experimental materials science than intelligent device engineering. Unfortunately, I did not see the publications of Dr. Nishikawa, nor did I get a sense of the extent of student involvement in the research projects of this lab.

Summary and Conclusions

The overall sense is that there is a lot of very good quality research, both fundamental and applied, being carried out in this department. In general, the results are being disseminated in archival quality journals. A large percentage of the published papers are written in surprisingly good English and appear in well-known international journals.

I was pleased with the enthusiasm displayed at all levels from professors to students. The number of master students and undergraduate students involved in research is very high. However, I was expecting to find more doctoral students. The department should examine the effect of completion times as a contributing factor for not enough master program students

continuing in the doctoral program. Outstanding graduate students should be given the opportunity to fast track to a doctoral degree in four years after their bachelor's degree. Apparently, there is sufficient flexibility in the rules and regulations governing degree completion times at Okayama University to permit this.

I deliberately did not elaborate on the funding of research programs. As in Canada, a sizable portion of research is government funded. Industrial support varies from professor to professor and from year to year but it is not necessarily an accurate indicator of research quality. What I did not witness at Okayama University in comparison with the University of Toronto and other Canadian universities is professors incubating and running startup companies on the side. Usually this activity occurs at the expense of teaching and therefore, it does not help the students. However, such business activity may help increase research funding.

Some thought might be given to labs within the department having more than one full professor associated with them. There is no need to invent a lab for every senior professor in the department. This is the North American way, which also allows associate professors to be promoted by a serious review process to full professors within a lab or group. In most cases such promotions do not bring about an immediate monetary reward. Furthermore, as long as the professors within a group complement rather than duplicate each other's expertise, such promotions have a beneficial effect on both teaching and research.

Finally, I would like to express my gratitude to Dean Totsuji for the opportunity to review this department. I would also like to thank Professor Totsuji and the chair of the department, Professor Nara, and all the other professors in the department, for their warm hospitality. The department has an impressive array of first class researchers working on fascinating research projects and producing quality publications. I would like to assure everybody that my comments, including the critical ones, were meant to be constructive, and hopefully, will have a positive effect on the future of the department.

Short Biography

of

Adalbert KONRAD, P.Eng.

Adalbert Konrad (IEEE S'70-M'75-SM'84-F'95) received his B.Eng., M.Eng., and Ph.D. degrees in Electrical Engineering from McGill University, Montreal, Canada in 1970, 1971 and 1975, respectively. In 1975, he was visiting researcher at the Polytechnic Institute of Grenoble, France. Following that he worked at the National Research Council in Ottawa, Canada. In 1979 he joined GE Corporate Research and Development, Schenectady, NY. There, as a member of the Electromagnetics Program he was involved in the development of finite element methods and computer programs for the numerical solution of electromagnetic field problems with applications to transformers, motors, ceramic electronic packaging, microwave integrated circuits and rf scattering. During the following years he was actively involved with the Schenectady Section of the IEEE, serving as its chairman in 1986-87.

In 1990 he became Associate Professor in the Electrical Engineering Department of the University of Toronto. He has been an IEEE Fellow since 1 995. In 1 996 he was promoted to the rank of Professor. His current technical interests are in the areas of field analysis of electromagnetic devices subject to EMI, electromagnetic acoustic transducer analysis and optimization, nonlinear magnetic circuit analysis methods, and bio-impedance diagnostic techniques.

Dr. Konrad has over 1 65 publications. He has been an enthusiastic promoter of computational electromagnetics by organizing and participating in workshops and conferences. He is a founding member of the International Compumag Society. He served as a member of the Steering Committees of the COMPUMAG, CEFC, ISEF and other conferences, and the editorial boards of the ACES Journal and the IEEE Transactions on Microwave Theory and Techniques.

２　生物機能工学科

２　生物機能工学科

評 価 結 果 の 概 要 等

生物機能工学科では、国際標準からみた本学科の教育・研究および施設・設備の水準を知るため、平成 15 年 3 月に外国人研究者を招聘し、外部評価を実施した。評価者の選考にあたっては、学科の教授に推薦を依頼し、推薦のあった複数の候補者の専門分野を考慮し、学科の教育研究分野のなるべく広い範囲を評価していただける方として、オランダ・デルフト工科大学名誉教授 Johannis A.Duine 博士を選んだ。交渉の結果、局氏は依頼を快諾され、外国人研究者による外部評価が実勢した。

評価者である Duine 教授は生物工学分野の国際的権威で、その略歴は以下の通りである。
生年月目：1937 年 3 月 16 目
学歴：1963 年デルフト工科大学化学工学部化学工学科卒業
　　1970 年同博士（Pb.D）の学位取得
職歴：1963 年ライデン大学助教授
　　1970 年デルフト工科大学準教授
　　1985 年同教授（酵素学）
　　2000 年同退官
専門分野：酵素触媒化学（酸化還元酵素における新規補酵素、キノプロテインの反応機構、細菌の呼吸鎖）、酵素工学（酵素を利用した速度論的分割法、診断薬への酸化還元酵素の利用）

Duine 教授による外部評価の日程は以下の通りであった。
2003 年
3 月 13 日（木）午後：岡山駅に出迎え。学部長訪問。事務手続き等とスケジュールの説明等。
3 月 14 日（金）午後：岡山大学および工学部に関する概要の説明。評価の実施に関する打ち合わせ。
3 月 17 目（月）午前・午後：4 つの教育研究分野の研究室訪問と教授讐とのインタビューによる教育研究活動の説明。
3 月 18 日（火）午前・午後：4 つの教育研究分野の研究室訪間と教授讐とのインタビューによる教育研究活動の説明。夕方:学科教授との懇親会。
3 月 19 目（水）午前：学科長とのインタビューによる学科概要の説明と質疑応答。
　　午後:講演会とインフォーマルセミナー。
3 月 20 日（木）午前：評価報告書の作成に関する打ち合わせ。
　　午後酵素機能〕〔学研究室で専門分野のディスカッション。
なお、各分野における教育研究活動の理解のために、本学科の英語版ホームページのプリントアウトと各教員の過去 6 年間の発表論文リストを参考資料として予め手渡した。また、講演会とインフォーマルセミナーを開催し、さらに、評価者と専門分野の近い教育研究分野の研究室で半日閥のディスカッションを行うことで、学科の日常的な活動と学問的な雰囲気を感じてもらい、評価の一助とした。

以上をもとに、学科全体の教育研究組織、学科の研究活動、施設設備、教育活動、各教育研究分野における個別の研究活動、の各項目に関してそれぞれ評価を受けた。評価結果は別紙報告書にある通りであるが、大略、以下のような指摘があった。

(1) 日本の大学の学部・学科に共通することであるが、この学科を特徴づける主導的テーマが欠如している。これに関連していると思われるが、研究分野の名称と実際に行われている研究内容の間に乖離がみられる場合がある。また、研究グループ内でテーマの一貫性が低い場合も見受けられる。

(2) 研究分野としては、微生物生理学や生体エネルギー論、発酵工学(代謝工学)等が欠けており、学生に選択の余地がない。

(3) カリキュラムは生物工学の教育に適したものになっているが、かなり重複がみられる。各教員がそれぞれ最先端まで熱心に講義しようとするあまり、単生へのロードが増し、かえって学生の熱意をそぐ結果になってはいないか。重複を避けることで学生へのオーバーロードをなくし、意欲を高められるのではないか。

(4) 演習を増やすことにより、学生の意欲を高める効果が期待できる。科学と工学の倫理的側面を講義する科目もあることが望ましい。

以上のような指摘は受けたが、本学科の研究活動は全体としては、日本のトップレベルの大学に相当するレベルにあるという高い評価を得た。また、施設・設備等についても、生物工学の研究や教育を行う上で必要な設備や部屋がよく整備されているという評価であった。

このように、Duine 教授を招聘して行われた今回の外部評価の結果、国際標準からみた本学科の教育・研究活動と施設・設備の高い水準が明らかとなった。生物工学分野の国際的権威からのこのような指摘と評価とを今後の教育研究の改善、施設設備の整備に役立て、もって国際化時代にふさわしい科挙技術の発展とそれに貢献できる人材の育成に努めていきたい。

Duine 教授は大変気さくで日本の大学の事情にも通じた方である。3 月という超多忙な時期に過密なスケジュールで行われた外部評価であったが、学科教授等とのインタビューをはじめ学科教職員との交流が終始和やかで友好的な雰囲気の下に行われたことが印象的である。稿を終わるにあたり、遠方よりお出でいただき、精力的に評価を実施され、適切かつ有益な助言をいただいた Duine 教授に心からお礼を申し上げます。

評　価　結　果

External review report (April 2003) on the Biotechnology Department, Faculty of Engineering, Okayama University, Japan.

Introduction.

My relationship with Biotechnology is based on the following. Before my retirement, working as a full professor in Enzymology at Delft University of Technology, I was involved in founding the Kluyver Institute for Biotechnology. The Institute is a collaboration between research groups of that University (engineering) as well as from Leiden University (biosciences). Furthermore, I have been a consultant for several biotechnology-based industries in The Netherlands, Germany and Switzerland. Several findings of my research group have been further elaborated in cooperation with industry, one of them having led to a successful practical application in the field of medical diagnostics.
After my retirement, I have been a visiting professor and external reviewer at Universities in Japan (a.o. for the Faculty of Agriculture, Kyoto University). Before that, I had many contacts with Japanese research groups, had many visits to Japan, and had several Japanese guest scientists in my lab. Moreover, I have been the organizer of several Dutch/Japanese joint meetings on Biocatalysis/Biotechnology held in The Netherlands. So in conclusion I dare to say that I am familiar with Biotechnology, and with some culture-derived aspects unique to research and education at Japanese Universities.

The review was commissioned by dr. Hiroo Totsuji, Dean of the Faculty of Engineering.

The evaluation is based on the very useful documentation provided before my arrival by the Chairman of the Department, a 6-days visit in which interviews were held of at least one hour with each of the participating groups, and by further discussion with the Chairman after the interviews were held. Unfortunately, my visit was in the last part of March so that most of the students were absent. However, from the short visits to the labs and from a seminar organized by Prof. Toraya's group I got a flavour of the facilities and the daily work circumstances,

In this report I will give my impression of the Department as such but also of the individual groups. Although I realize that in view of limitations in my expertise and my personal focus the latter is a little bit risky, since the research leaders did so much effort to explain me the relevance of their projects and to document their output, I think I should do this and just give my impression in a straight forward manner. I hope that the judgments will be recognized as constructive criticism.

General Impression of t/1e Department.

Organization.
Looking at Departments/Faculties of Japanese Universities, and this Department is no exception, to me as a European scientist the following aspects are always surprising: I . the absence of a general leading theme; 2. the curious name giving of the participating groups/labs as compared to what they are doing. I think I know the reasons for that: ad. I . there is no top down pressure to force biotechnology groups to organize into an institute or a centre of excellence; ad. 2. names are more or less related to the teaching obligations originally expected from the professor nominated at the chair, not to the research projects presently carried out. Of course it can be reasoned that this situation is typical for a

Department at a Japanese University, and as said already, indeed it is. However, I think it could be useful to discuss now and then whether the situation should either be prolonged or changed. Therefore> in the perspective of how the two main tasks, teaching and research, could be improved, further discussion on this issue is presented in the Consideration & Recommendation section.

Research.
Nowadays Biotechnology comprises a broad range of topics and most Departments in this field are too small to cover them all. Since this Department forms part of the Faculty of Engineering, focusing on fermentation technology would lay at hand. However, since research topics in microbial physiology, bioenergetics, and metabolic/fermentation engineering are lacking, momentarily this would be no option. In view of the faot that the Research Institute for Bioresources in Kurashiki forms part of Okayama University, Agricultural Biotechnology could also be an option. However, also for this essential parts (plant physiology etc.) are lacking so that again at present this is no option. From the topics carried out I conclude that this Department focuses in fact more or less on Medical Biotechnology. I do not know the arguments for this choice but in view of a large Medical Faculty in this University, I can understand it.

Although the Department is not an Institute with formalized structures, I got a good impression of the willingness for cooperation between the research groups. Apparently, good relationships exist so that cooperation can develop on a free base and technical facilities are shared. One of the admirable initiatives in this is the recently acquired know-how for determination of 3-D protein structures in the lab of Applied Enzyme Chemistry. The Dep. is well equipped with facilities (instruments, general purpose rooms) for research and education in Biotechnology.

As is not uncommon in a University Department, also here the research quality of the participating groups varies (see below). However, my judgment on the research of the Department as a whole is that its quality is at a comparable level to that of Biotechnology Departments/Faculties belonging to the top Universities of Japan.

Education
Worldwide, interest among students to study Natural Sciences is at a low level, that is they prefer to study e.g. law or economics and if they study one of the natural sciences, their enthusiasm is sometimes low. As this problem has many facets, no general solution can be given for that. In the field of Biotechnology, one of the facets is that during the past decade the field has expanded so much that even for a trained scientist it is difficult to keep ahead with all the new developments. Since it is common practice (and this is admirable) to bring the students in touch with the newest developments and every professor in the Department wants to contribute to this, as a consequence the teaching load of the students is high. Does this contribute to keeping the students enthusiastic? Some professors recognized the problem and told me that they avoid bringing too much facts in their teaching by presenting them on their website.
Looking at the educational activities of each group, I noticed that sometimes there is substantial overlap in the topics of the curriculum. In the comment on that it was argued that repeating some topics is beneficial to the students as it gives them more than one opportunity to understand the matter. However, again does this contribute to inducing the student's enthusiasm?

From the information given in the documentation. I see that the students get a respectable overall program that is adequate for training in Biotechnology. However, in lack on data about this (quality assessment by response from students or from their employers), I cannot estimate the adequacy of the teaching performance or whether the program really fits the expectations of the employers of the students.

Individual Groups.

Lab of Gene Engineering.
This group focuses on interesting research topics. However, the coherence between them seems rather low to me (production of special proteins in Gram-positive bacteria, proliferation and differentiation of neutrophils). Perhaps the diversity originates from different interest of the group leader and his co-workers? If so. I can understand this but I think as a consequence, the research output of the group as a whole could be better than it is now.

Lab of Applied Enzyme Chemistry.
At first sight, the topics (enzymology of vit. B12-enzymes, study on signalling proteins) of this group seem rather diverse. However, as became clear during the interview, after studying the catalytic features of one type of enzymes for many years, the group wants to make a step to a higher level of complexity, the interaction of proteins in a signalling pathway. I fully agree that this is an interesting scientific challenge and from the list of publications I see that the new topic is already productive.
Although the name of the lab suggests so, no research topics specifically related to application are carried out. Of course insight into fundamental aspects of enzymology can solve problems related to application but what about taking the initiative in focusing more directly on the applied aspect? For instance. I could imagine that the advanced knowledge obtained on biocatalysis of free radical chemistry could be useful for the development of mimicking chemical catalysts and that starting a (collaborative) project on this could be worthwhile.
The output lists show a number of high-1evel publications, in line with my impression that this lab is one of the top quality groups in the Department.

Lab of Applied Cell Biology.
Research on a number of very interesting topics is carried out by this group. I am not familiar with this field of research but after the explanation given by the group leader. I could understand the coherence between the projects. Based on the output and other impressions, this lab is one of the top quality groups in the Department.

Lab of Biochemical Engineering and Sciences.
As is in the name of the lab, research on a diversity of topics (some of them related to engineering, others to practical issues or just interest in characterization of a certain enzyme) is carried out. Although many of these topics are interesting and especially those studying problems related to application are highly relevant, such a diversity can also form a danger as the efforts are too diversified. On the other hand it is clear to me that this group not only contributes to finding solutions for practical problems but also has reasonable output with respect to publications.

Lab of Biomaterials
During the interview, the leaders of this group gave a very clear presentation of their program. The group has done many interesting findings in the field of biomedical materials. However,

is the research they are doing of academic level or could it be better carried out in an institute for applied research? Many of their findings throw up very challenging questions in the fields of chemistry, physics material sciences, requiring interdisciplinary research to solve them. During the discussions it became clear to me that in the future their research will be focusing more on these questions than on continuation of the present strategy. In the context of what has been said above, I fully agree with this.

Lab of Bioorganic Chemistry.
This lab focuses on the synthesis of physiologically active molecules. Based on the documentation and the interview, it is concluded that this group has an excellent output with respect to research and teaching.

Lab of Protein Engineering.
This group has several ambitious goals, reflecting the vivid imagination of the group leader. Although very interesting from a scientific point, in view of the low level of integration of them, are there not too many?

Lab of Bioelectronics and Biophotonic molecules.
I must say that I am impressed by the original approaches of this group with respect to solving key issues in biochemistry and biotechnology. The high quality papers published by the group indicate that they are not only able to generate original ideas but also to work them out. One of the top quality groups in the Department! Hopefully, the gap after the present staff members have left will soon be filled up with capable successors.

Considerations & Recommendations.

1. As will be clear from the comments given above, the coherence of the topics in certain research groups is sometimes low. This also applies more or less to the labs in the Department. I think I know the reasons for that: historical ones (e.g. the presence of an associate professor, having his own topics already, before the full professor arrived); the freedom of Japanese full professors with respect to the choice of their topics (the selection of their identity mainly based on their expected contribution to teaching); absence of a leading theme (with respect to research) in the Department. Of course I agree that freedom is necessary to achieve the highest level of performance of a scientist. On the other hand, I have the feeling that introduction of formalized structures and focusing on a leading theme could strengthen the Department with respect to depth of its fundamental research and what type of applied research should be done and respected. Forced cooperation does not work but I think a discussion on the advantages and disadvantages of the two choices should be held now and then.
2. Formalized structures could also be helpful to achieve the construction of a well balanced curriculum. To avoid overlap and overloading of the students, consensus should be attained about the content and the weight of the curriculum. Problem-based teaching could be helpful for the students to find their own way in mastering basic facts of knowledge and to keep them enthusiastic. A lecture series on ethical aspects of science and technology could keep the student aware of social impacts of science and technology and to provide the student with a critical attitude.

Epilogue.

Especially with respect to the evaluation of individuals groups, one should realize that it is a one-man's-judgment. In general, organizations should look now and then in a mirror to see whether they are still on the right track. In this context, my comments should be seen as one of the mirrors to achieve that goal. I hope they will contribute to the well being of the Department in the future.

Dr. J.A. Duine,
Professor Emeritus in Enzymology at Delft University of Technology,

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３　通信ネットワーク工学科

3　通信ネットワーク工学科

評 価 結 果 の 概 要 等

通信ネットワーク工学科では.外国人研究者による外部評価を平成 15 年 2 月 17 目～19 日に実施したので，以下にその概要を報告する.

① 評価者選考の経緯

本外部評価に当たっての評価者の選考であるが，①通信ネットワーク工学科ではコンピュータおよびネットワークのハード・ソフト両種に渡る研究・教育を中心としているが，それに近い分野の学科に所属していること，②専門としている分野で世界的権威であること，③現在日本の多くの大学がモデルとしているアメリカの大学に所属していること，などを念頭に入れて行った．その結果,アメリカでもトップレベルの研究大学である，カリフォルニア大学サンタバーバラ校電気コンピュータエ学科のマレックサドゥスカ教授を評価者として選考し，外部評価を実施して頂くこととなった．同教授は，現在，同大学のコンピュータエンジニアリンクプログラムのディレクターを務めているが，本プログラムでは，コンピュータのハード面・ソフト面をバランス良く教育を行うカリキュラムを提供していることから教育癒での評価者としては適任と考える．また、同教授は VLSI システムの自動設計分野で世界的な権威であり，IEEE フェローであるのみならず，様々な論文誌の編集長や編集委員，国際会議の議長などを務めておられることから，研究面での評価者としても最適な研究者と考えられる.

② 評価者の略歴

マレックサドゥスカ教授は，1976 年にワルシャワ工科大学（ポーランド）より電気工学に関する工学博士の学位を取得後，1982 年まで同大学での助教授を務めた.その後，カリフォルニア大学バークレー校電気工学科で研究員となり，1990 年からカリフォルニア大学サンタバーバラ校電気コンピューター工学科の教授を務めている．1989 年から 1993 年までは IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems の編集員を，その後 1995 年まで同論文誌の編集長を務めた.本論文誌は，VLS1 システムの自動設計分野では世界で最も権威のある論文誌の一つである．また 2002 年より，同大学コンピュータエンジニアリンクプログラムのディレクターを務めている.

③ 評価実施日程

平成 15 年 2 月 17 日～19 日の 3 日間で、本外都評価を実施した．1 日目（17 日）は，事務手続き，工学部長訪問，スケジュール説明，岡山大学および通信ネットワーク工学科の概要説明，古賀研究室の評価を実施した後，夜に本学科教官との懇親会を開催した．2 日目（18 日）は，森川研究室・奏研究室の評価の後，午後,、「カリフォルニア大学サンタバーバラ校コンピュータエンジニアリング教育プログラムの紹介」という題目で，大学院自然科学科大講義室で，本学科全教官・学生に対

する講演を実施して頂いた．3 日目（19 日）は，杉山研究室・横平研究室・松曳研究室の評価，学科全体の評価と講評を実施して頂いた．

④ 評価結果の概要

イ 研究・教育活動

まず研究活動についてであるが，本学科の規模（教授 5 名，助教授/講師 4 名，助手 4 名といった非常に小所帯)に比較して，通信ネットワーク工学に関する非常に幅広い研究活動が行われていると評価して頂いた．すなわち，光ファイバや無線などの物理レベルでの研究から，プロトコルや符号，信号処理，コンピュータアーキテクチャ，セキュリティといった応用レベルでの研究まで，通信ネットワーク工学に関する研究分野が幅広くカバーされている．また，その中の幾つかの研究分野は世界的レベルにあり，マレックサドゥスカ教授のご専門である VLSI システム設計やそれに近い環境電磁工学分野の研究者とは，今後も情報交換を行って参りたいとの感想を頂戴した．

次に教育活動についてであるが，通信ネットワーク工学という比較的新しい工学分野での教育を提供するために，それに関連する電気工学，コンピュータエ学.情報工学，通信工学などの分野から必要な科目を集めて新しいカリキュラムを構築しており，科目の構成としては現段階では適したものと判断する．しかしながら，それら異分野間の融合については，まだまだ改善の余地があり，更なる努力が必要であるとの評価であった．

ロ 施設・設備讐

学科の設備については，研究面，教育面共に，小規模ながらも必要な設備を揃えており，その努力を高く評価して頂いた．しかしながら施設，特に建物については，現状 4 箇所に分散していることを指摘され，このような小規模学科は同一建物に配置すべきであるとの非常に厳しい指摘を頂戴した．その他の指摘事項を列挙すると，まず，本分野の世界的な急成長にも拘わらず，学科の規模（教官数，学生定員）が非常に小さいこと，事務官や技官などの支援スタッフが弱いことなどは理解に苦しむといったことであった．その対策として，カリフォルニア大学サンタバーバラ校のコンピュータエンジニアリンクプログラムのように，関連する他学科とカリキュラムを部分的に共通化することなどは，有効な方法ではどの指摘を受けた．また，将来的には，学生の多様化や研究の国際化に備え，外国人や女性の教官を採用すべきこと，学科長の強いリーダーシップが大切であることなどを指摘して頂いた．

⑤ 今後の取り組み方針

今後は，本外部評価でポジティブな評価を受けたものについては更にその発展を図ると共に，ネガティブな評価については真摯こ受け止め，少しでも改善すべく努力して参りたい．特に教育面では，カリキュラムの再編成を行い，通信ネットワーク工学分野の確立を図りたい．その他学科レベルで実現可能な指摘事項については，今後その対応を図って参りたい．

評　価　結　果

Department of Communication Network Engineering
Okayama University
External Review Report

April 2003

Malgorzata Marek-Sadowska
Department of Electrical and Computer Engineering
University of California, Santa Barbara

Preliminaries and Program

This review of the research and educational activities in the Department of Communication Network Engineering was initiated by the Dean of the Faculty of Engineering, Professor Hiroo Totsujl, together with Professor Nobuo Funabiki, Chairman of the Department. The purpose of the review is to provide information on extending the research activities of the Department from an international point of view, particularly from the perspective of a professor in a research-oriented university jn the U.S.A., and to obtain advice regarding the education program.

My technical background is based on more than 25 years' experience in universities in Poland and the United States. From 1976 to 1982 1 was an assistant professor at the Institute of Electron Technology at the Technical University of Warsaw, Poland I was a visiting professor in the Electrical Engineering Department of the University of California at Berkeley from 1 979 to ~ 980. Then, I became a research engineer at the Electronics Research Laboratory, University of California at Berkeley until 1990, when I joined the Department of Electrical and Computer Engineering at the University of California, Santa Barbara, as a full professor.

The review was conducted over three days of February 1 7-1 9, 2003, with the following schedule:

February 17:

Introduction of the schedule and the overview of the Department

Visiting Professor Koga's laboratory for evaluations

Discussion on research areas related to EDA (Electronic Design Automation) with several professors

February 18:

Visiting Professors Morikawa's and Hata's laboratories for evaluations

Seminar, "Computer Engineering Program at University of California, Santa Barbara:'

February 19:

Visiting Professors Sugiyama's. Yokohira's, and Funabiki's laboratories for evaluations

Comments on research and education in the Department

Observations on Research

My main purpose in this external review is to comment about the research activities in the Department of Communication Network Engineering. I found that a variety of research activities related to communication network technology have been carried out here, although the number of faculty members is relatively small. This Department is composed of only five professors and four associate/assistant professors with four research associates. Some of the faculty members focus on fundamental technologies for communication such as optical fibers, radio transmission, and lasers Some are interested In information processing technology such as coding, signal processing, and compaction. Some specialize in communication protocol design and internet architecture. Other research subjects in this department include network security, computer architecture, and system design methodology. Notwithstanding the very short history of the department, I observed significant progress toward a well-organized blending of electronic and communication engineering and information technology. I found some of the research activities to be at the cutting edge of their fields, and most are at a sufficiently high level

to meet international standards. I had opportunities to exchange information on research related to EDA and EMC, and I was deeply impressed by the researchers' achievements. I would like to continue communication on research with faculty members in this department. We might also pursue collaboration in the near future.

Here is the summary of the research activities.

Network Devices Laboratory (Professor Koga)

In this laboratory, the following research topics are studied: l) development of network devices; 2) innovative design of electronic and optoelectronic devices and systems, including optical communication systems; and 3) electromagnetic compatibility in systems, to improve speed of data communication systems and their reliability. Electromagnetic compatibility (EMC) is a research field that attempts to develop a device or system that functions without error in its intended electromagnetic environment. It addresses problems in both EMI (Electromagnetic Interference) and EMS (Electromagnetic Susceptibility). New normative methods based on the theories of electromagnetics as well as electric and electronic circuits are developed for EMC designs of practical devices and systems. Optical integrated circuits (optical ICs) such as optical filters, switches, and modulators are essential for high-speed and highly reliable systems in communication and information processing systems, where they have proposed innovative optical circuits. The research activities of EMC are funded by JSPS (the Japan Society for the Promotion of Science), and high-quality research is being carried out with the society's support of laboratory facilities. International collaborations are also being implemented so that the exchange of knowledge is bringing the work in this laboratory to the international level. Researchers from commercial companies are joining the group as Ph.D. students who can harmonize basic research with its application to practical engineering. Research topics cover a wide range, from modeling of semiconductor devices to simulation and measurement of practical digital circuits and systems. I found the work to be excellent.

Information Transfer Fundamentals Laboratory (Professor Morikawa)

In this laboratory, I observed research activities in three fields. The first one is image coding. After standardization for compression of still pictures (JPEG) and moving videos (MPEG), image data transmissions are frequently used on the Internet, so the transferred data expands rapidly. They are studying efficient compression methods for image transmission; specifically using vector quantization with the Gaussian mixture model for adaptation. The second one is cryptosystems for secure communication. While RSA system utilizing the difficulty of integer factorization is used in the Internet, some scientists think such systems might become dangerous in the near future because of the rapid increase of computer speed. In this laboratory, cryptosystem using the difficulty of discrete logarithm problem defined on elliptic curve has been researched. They have attained one special objective -- that the system is realized on computing elements of even low performance such as an IC card. The third field is image processing. This field includes restoration of blurred, noise-contaminated images and 3D reconstruction algorithms for X-ray cone-beam measurements. The former processing Is performed on the image modeling by Gaussian mixture. Restoration performances have been highly improved compared to existing methods. The latter processing has the objective of realization in

real-time 3D observation with X-rays. To this end they use the special structured filter bank for the reconstruction. This project was supported by Texas Instruments, Inc. I conclude that the activities of this laboratory meet high standards. Additional collaboration with industry would be desirable.

Mobile Communication Engineering (Professor Hata)

The service of ~MT-2000, the third-generation mobile-radio communication system, has been started recently. Although the maximum user rate of IMT-2000 is 2 Mbit/s, we can expect increases of more than ten times that rate in multimedia services for the next generation of mobile communication systems. To realize such broadband data services, and to cope with huge numbers of users, improving the high-capacity capability for future systems will become the most important objective. The research in this laboratory focuses on developing technologies to increase system capacity. To explore one of the efficient techniques proposed for this purpose, the researchers are studying a new radio access method, introducing the technique of time-division beam control into conventional multi-beam sectorization schemes. For future systems, they are also studying a mobile-radio link design method and layered-cel1-structure methods. Further interests include research on mobile-radio propagation characteristics, frequency-sharing issues, and spectrum-usage evaluation methods. The research activities presented show a good mixture of basic research and industrial applications, which is very desirable preparation for students. The working conditions in this laboratory (state, space, equipment and location) are satisfactory, but additional staff will be needed to develop its full potential.

Information System Fundamentals Laboratory (Professor Sugiyama)

The research subjects in this laboratory are as follows:

l. Design Verification of Asynchronous Logic Circuits. In order to design correct asynchronous logic circuits, the researchers study methods for specification and verification.

2. Method for Designing Asynchronous Processors. It is becoming increasingly difficult to design high-speed synchronous circuits. A global clock signal cannot synchronize every component in a large circuit system, because wire delays are no longer negligibly small in comparison with gate delays. The goal of this study is to develop a systematic method for designing asynchronous processors. They adopt modified control-flow graphs to represent execution sequences of operations. This method excels at reducing costs for synthesizing speed-independent circuits.

3. Cryptographic Communication Protocols:

   3a. Electronic Cash Systems. Toward realizing electronic payments over the Internet, researchers propose electronic cash protocols to achieve security, privacy and convenience.

   3b. Electronic Auction Systems. In sealed bid auctions, anyone should be able to verify the correctness of auction results. In addition, to protect user privacy, it is desirable to hide bid prices even after the winner has been determined. They propose efficient protocols to satisfy such requirements.

   3c. Group Signature Schemes. Group signature schemes allow any user to prove his/her group membership without revealing the individual's identity. As cryptographic tools are developed to realize this security protocol, they have proposed a group signature scheme.

4. Video Image Affine Transformer and Projective Transformer. Affine transformation Is a basic geometric

one, which is useful in giving visual effects to Images. They have developed architecture for the video image affine transformer, with a small amount of hardware.

Because some of this work is outside my area of expertise, I cannot evaluate these projects in any detail. The research subjects, however, comprise an impressive array of interesting and relevant works.

Network Design Laboratory (Professor Yokohira)

The Internet has become indispensable as infrastructure for a highly information-oriented society. However, current Internet capabilities cannot guarantee the quality of service (QoS) such as transmitting information within a predetermined delay time. In this laboratory, with the aim of realizing next-generation Internet technology which can guarantee QoS, researchers have studied connection admission control for real-time communication in packet-switched networks, wavelength assignment algorithms in packet-switched networks with wavelength division multiplexing, design of content-delivery networks, secure and efficient access methods for hierarchical VPNs, and dynamic traffic-balancing methods on multihomed networks. These themes are very important, and the research activity of this laboratory seems to be of high quality.

Network Security Laboratory (Professor Funabiki)

In this laboratory, research activities focus on Network Security, Optimizations in Communication Networks, Combinatorial Optimization Algorithms, Face Image Processing, and VLSI Design Automation Algorithms. In Network Security, researchers have presented a system for file encryption / decryption with duplex keys, and a detection system of illegal file-opening operations, as tools to protect important files using HTTP request commands. Currently, they are dealing with the unification of these systems and their functional expansions. For Optimizations in Communication Networks, researchers have studied algorithms to solve a variety of optimization problems in communication networks. Particularly, they focus on problems related to new-generation mobile networks, including link-activation scheduling, routing, and channel assignments. In Combinatorial Optimization Algorithms, they have studied heuristic algorithms for NP-hard combinatorial optimization problems in the graph theory and the combinatorial theory, such as graph coloring, maximum clique, largest common subgraph, satisfiability, and the application of their results to practical engineering problems. In Face Image Processing, they have studied efficient algorithms to extract face components (such as lips, noses, and eyes), with fine accuracy, from colored face images taken by conventional digital cameras. So far, they have proposed an algorithm to extract the lip contour based on the deformable-template-matching method, using four second-order linear functions, In VLSI Design Automation Algorithms, they have presented heuristic algorithms for channel routing, layer assignment, pin assignment, and module assignment problems in the VLSI design process. The research activities in this laboratory are productive and valuable, although only one faculty member is assigned to supervise them.

Observation on Education

In terms of the evaluation of the education program, I saw only the class subject 1ist and the facilities, including computer laboratory and experimental rooms, shown to me with brief explanations by faculty members in this Department. Because the spring break has started in Okayama University, there was no class in session. After

these brief observations and discussions, I concluded that the education program in the Department of Communication Network Engineering is well organized It seems to have a suitable curriculum to educate prospective engineers in the area of communication network engineering, if we take into consideration the number of faculty members in the department (only 1 3 ~embers!) and the short three-year history of the new department. However, the fusion of two original areas, namely, information technology and electrical engineering, seems insufficiently integrated, so that students may be confused. In the future, partial reorganization of classes may be necessary so that the department can provide an education program flexible enough to keep current in This relatively new area of communication engineering.

Recommendations

Although the research activities and the education program in the Department of Communication Network Engineering are satisfactory, I have several recommendations to further improve them:

l . First, all the members in such a small department should be located in the same building. Otherwise, it will be difficult to coordinate the necessary collaborations and to facilitate the fusion of research and education activities.

2. I do not understand why this department size is so small, although the rapid growth of this field can be anticipated all over the world. I recommend expansion of the capacity of this department, including faculty members and students.

3. Support staffs such as technicians and secretaries are absolutely necessary for the proper management of the research and education programs in the department. The current situation, having only one technician and one secretary, is inadequate,

4. I recommend hiring some foreign and/or female faculty members so that the department can cope with the diversification of students and the new directions of research all around the globe.

5. Strong management by the chairman is essential for the development of the Department. The rotation of the chairmanship among full professors every year is absolute nonsense

6. A joint education program between two or more departments might be a good idea to offer a proper preparation for future engineers. For example, our department (ECE) has a joint education program with the computer science department (CS), which prepares students in computer engineering with both hardware and software background. Currently ~ am the director of this Computer Engineering program (CE).

おわりに

平成１４年度の外部評価では，電気電子工学科，生物機能工学科および通信ネットワーク工学科が，それぞれの分野の一流の外国人研究者による外部評価を受けれこれで工学部全学科が外国人研究者による評価を受けたことになる。

幸い，どの学科も国際標準に照らしておおむね高い評価をいただいた。しかし，いくつか改善すべき項目の指摘もあった。学科長の権限の不足や，支援スタッフの不足，あるいは学科を特徴づける主導的研究テーマの欠如などがそれである。これらの事項に関しては，現在の制度下では急速な改善は望めないが，法人化後に自由度が増せば，外部資金の活用などを通してそのいくつかは改善できる可能性がある。これらの事項は，その是非を含めて今後の検討課題とし，「個性の輝く」岡山大学工学部の実現を目指したい。

今回，外部評価をお願いした方々には，お忙しい中，遠方よりお出でいただき，精力的な評価と，適切かつ有益なご意見を多数賜りました。ここに深く感謝いたします。

平成１５年７月

岡山大学工学部自己評価委員会委員・評議員　山　田　秀　徳

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