



The 21st Century COE Program for Research and Education on Complex Functional Mechanical Systems



Kazuo Tsuchiya

Professor

Department of Aeronautics and Astronautics

1. Mission and Scope of the Program

The 21st Century COE (Center of Excellence) Program is an initiative taken by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT), with the goal of supporting universities in establishing international centers for education and research which are capable of becoming world leaders in their specific research areas. Our program of "Research and Education on Complex Functional Mechanical Systems" has been awarded the grant for carrying out advanced research and education as a Center of Excellence in the field of mechanical engineering in 2003 (five-year project), and is expected to be a leader in research and education both in Japan and worldwide.

Our objective in research is modeling, analysis, and control of phenomena and design theory geared specifically for complex mechanical systems, and is to form the basis of a novel field of study to be known as "Complex Systems Mechanical Engineering". On the other hand, our objective in education is to foster and develop innovative young researchers that will become leaders in these novel fields of study. The COE program provides significant opportunities for such development on the job, promoting broad perspectives, creativity, and a strong will in preparation for the entrance of our young scientists into the global research community. To this end, we will establish high-level joint teams combining specialized scientists and engineers from the four departments of the Graduate School of Engineering (Department of Mechanical Engineering, Department of Engineering Physics and Mechanics, Department of Precision Engineering, and Department of Aeronautics and Astronautics), one department of the Graduate School of Informatics (Department of Applied Analysis and Complex Dynamical Systems), and the Kyoto University International Innovation Center. Research will be conducted using the facilities of the five departments on Yoshida campus, and it will also be carried out at Katsura Intec Center, our interdisciplinary joint research facility.

2. Research Topics

The purpose of mechanical engineering is the analysis and design of mechanical systems, but the systems of long-term are becoming increasingly complex. The ability to generate interest weather forecasts has many socially and economically important consequences, and, at its core, this problem is governed by complex hydrodynamic phenomena arising from the interaction of different elementary processes at the atmosphere-ocean interface. Likewise, the development of robots that behave autonomously in a changing environment will be of great importance to many fields. The interaction of robots with their surroundings is extremely complex and requires a mechanical systems engineering approach to be fully understood.

Complex systems are generally composed of a large number of components that are coupled by nonlinear interactions. A key discovery of complex systems science is the description of complex systems themselves. In particular, fractal systems exhibit regularity through self-similarity while chaotic systems are simply nonlinear. As a consequence, complex systems form an ordered structure through self-organization in response to the environment. A complex system also develops its functions through this ordered structure. For example, the adaptive function, a typical function of complex systems, arises when a pre-existing structure in the system is preferentially selected and modified in response to the environment.

We wish to use the concepts and methodologies of complex systems science as they apply to complex mechanical systems. The combination of these fields would constitute complex mechanical systems engineering. Our specific research interests are as follows:

1. The modeling and analysis of complex mechanical systems
 - (1) Derivation of a reduced order model of complex systems
 - (2) Analysis of the adaptive functions of complex systems
2. Control and design of complex mechanical systems
 - (1) Stabilization control of the complex systems based on the reduced order model
 - (2) Development of autonomous robots
 - (3) Development of a man-machine interface with adaptive functions
3. Study of the basic mathematics of complex mechanical systems engineering
 - (1) Development of new analytical methods based on stochastic calculus
 - (2) Development of new model reduction methods
 - (3) Study of inverse problem analysis as the basic mathematical basis of design theory

3. Education program for young researchers

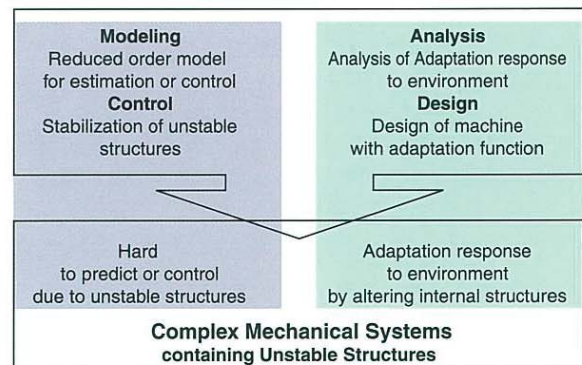
One of the primary roles of the 21st Century COE Program is to develop superior young researchers in their chosen fields. In this program, we will employ Kyoto University's tradition of on-the-research training to develop young researchers with broad perspectives highly specialized skills, and the ability and courage to act as trailblazers in novel fields of study. Various new systems and programs will be prepared for this purpose.

(1) Joint Interdisciplinary Research Program

To improve the research capabilities of those in the doctoral course, we will prepare and broaden a system to promote education as a joint act of the teacher and student in conducting research, examining a variety of viewpoints, and deciding upon experimental objectives and procedures. In addition to the joint research that has occurred in the past under the tutelage of a single instructor, a new system designated as the Apprenticeship is being established. In this program, a young researcher is allowed to participate in joint research unrelated to the department to which he or she belongs, including overseas research projects, for a set period of time. In addition, the student will be given opportunities to interact with instructors in other disciplines and participate in their research.

(2) Fellowship Program

Young researchers, post-doctoral research fellows and graduate school doctoral students, will be provided with comprehensive support for their research activities, including expenses for research, travels associated with joint study, and domestic and international conferences, so that they will be able to focus on their high-level research as independent researchers.



工学部協定校巡り

バーミンガム大学紹介



永田 雅人
航空宇宙工学専攻 教授

イングランド中部のMidland shireにあるBirmingham市が連合王国第2の都市であることはあまり知られていない。地理的優位性を活かしRover、Rolls Royce、Jaguarなど英国産業の発展を支えてきた伝統工業と密接に関わってきたが、近年、工業都市から文化都市へのイメージ・チェンジに力を注いでいる。European City of Flowersに選ばれたこともあり、中心街は大規模な改造計画が進行中で著名な建築家たちの現代建造物と教会など由緒ある建物が見事にマッチしている。1998年冬季オリンピックが長野に決定されたIOCの会議が開催されたConvention Centreや、ベルリン・フィルの音楽監督になったSir Simon Rattleが育てたCBSO(City of Birmingham Symphony Orchestra)の本拠地Symphony HallがVictoria Squareにある。また、ウィンブルドン前哨戦として芝生コートの足慣らしのために多くの女子テニス・プレーヤーが出場するDFSクラシックが毎年6月にEdgbaston Priory Clubで催される。ちなみに、すぐ隣町のCoventryは、ベルギー製Godivaチョコレートで有名なLady Godivaが市民を苦しめる重税を夫である領主が取り下げることと交換条件で裸で馬に跨り街中を巡り歩いた伝説の町であり、その裸姿を覗き見したため目がつぶれてしまった男が「Peeping Tom」の語源となった。

私は、1990年にバーミンガム大学数学統計学科のレクチャラーとして採用され、1998年に京都大学に赴任するまで研究と教育に携わった。中心街から約5キロ離れたEdgbastonは日本人にとっては仰天するほど大きなマンション(豪邸)が建ち並ぶ閑静な地区で、その一角にある定冠詞付きのthe University of Birminghamは1900年に創立された旧制大学(Old Universities)の一つであり、学部生約17,000名、大学院生約8000名のキャンパスの美しい総合大学である。大学の西門にはBR(British Rail)の「University」駅が、また、東門にはBarber Institute of Fine Artsと呼ばれる小さいながらも、モネ、マネ、ロゼッティ、ドガ、ゴッホなどの絵画を多く所蔵している美術館がある。その美術館に隣接している音楽科ではかつて英国の誇る作曲家Edward Elgarが教授をしていた。その西隣のWatson Buildingが数学統計学科の建物である。Watsonとはラプラス変換論にでてる「ワトソンの補題」のGeorge Neville Watson(1886-1965)である。Watson Buildingの南には理学部、さらに西に進むと広い芝生の中庭Chancellor's Courtがあり、北には図書館、中央には高いレンガの時計塔、その南にはAston Webb Buildingと呼ばれる中枢事務局の建物がある。さらにその南にはグラウンドがあり南門に面している。中庭の西側にはUniversity Centreとよばれる建物があり、2階以上はStaff House、Senior Common Room、Staff専用食堂、一階にはパブ、学生食堂、銀行、美容室、書店、文房具店、スーパーなどの商店が入っている。University Centreの西はスポーツ施設Munrow Centre(体育館、温水プール、スカッシュ・コート、ジム、陸上競技場)と工学部(土木、機械、化学、生物化学)がある。ビタミンCはこの化学工学科教授

Walter Norman Haworth(1883-1950)が初めて合成に成功し1937年にノーベル賞を受賞している。西門を経て「University」駅をすぎた所にQueen Elizabeth Hospitalと名づけられている大学病院がある。さきほどの中庭の北にある図書館のさらに北にはMuirhead Towerと呼ばれる多少不釣り合いにみえる高層の建物がそびえ、その建物とその周りは文学部、教育学部が占める。その北は道を隔てて電気電子工学科、計算機センターと続く。この道は東門から北へ向かう道とT交差しており、さらに北へ向かうと道の両側には、地元ならではのシェークスピア研究所、ゲストハウス、ナーサリー(造園植物園)、学生寮などが建ち並ぶ。特に、かつての英国首相の名を持つ学生寮Chamberlain Hallはthe Valeと呼ばれる大きな池のある緑地を見下ろし、周りは学生にとって格好の散歩場所となっている。

教育に対しては特に熱心で、ヨーロッパの大学連携組織、「Universitas 21」の創設メンバーでもある。また、2001年に行われた研究に関する全英大学評価(UK Research Assessment Exercise)では、対象となった49分野のうち32分野が6段階評価で最優秀点を獲得し、総合評価でもCambridge大学、Oxford大学、London大学University College、Manchester大学に次ぐ全英5位を誇っている。

バーミンガム大学はイギリスを代表する大学のひとつとして今後もますます発展していくものと考えられ、アカデミックな交流が促進されることを強く望むところである。



Great Hall (Aston Webb Building)

3 Days of Memories in Japan



Nguyen Pham Hong LIEN

International Doctoral Course
Department of Urban and Environmental Engineering
Graduate School of Engineering

When I first arrived in Japan, I was impressed by the article of Professor Junzo Ishikawa in one of the Graduate School of Engineering's newsletters. According to his experience in England, "International exchange, in its truest sense, is to study and to understand the culture of a country different from one's own." This is the first time for me to come to Japan but the second time for me to study abroad. So, I believe that too. Shortly after having read that article I was lucky to join a trip organized by

the Graduate School of Engineering.

It was a cold, rainy day in the middle of November when we started our 3-day trip. Waiting for the Shinkansen train at Kyoto station, all the 30 members from different countries appeared very excited. I was glad to learn that I would be sharing a room with 3 girls from Sri Lanka, Korea and Thailand during the trip. On the train we began talking actively in groups.

Kenrokuen Park looked beautiful despite the rain. It was the first stop of our journey in Kanazawa and is one of the three most beautiful walk-around style gardens in Japan. I had never expected to see cherry-blossoms in autumn, however I was able to see them for the first time in Kenrokuen Park. Following lunch we enjoyed a gold-leaf craft class, and spent 2 hours making our own handicrafts. My Korean roommate Moonjeong appeared to be very good at this craft. As for myself, I was also happy with my 'art product', planning to take it back with me to my home in Vietnam.

We visited Shirakawa, a World Heritage site, and stayed one night in 'Gassho' houses. I particularly liked the unique style of these houses which have been maintained since the 18th century in this remote village. Surprisingly, it was very comfortable to stay in the house and learn about the Japanese traditional style of living. Outside it was raining and cold, but inside we were warmed by the charcoal fire and, more importantly, by the amicable talk among us.

On the second day, the weather was favorable for us - sunny and cool. We went to Takayama to enjoy the world of Japanese festival in Festa Forest. Later we walked around Takayama town and I realized why it is called 'Little Kyoto'. The old streets, temples, shrines... all seemed to have been untouched by the passage of time. We had to leave at 2 pm but many of us took lunch in the bus since we just wanted to spend as much as time as we could experiencing Takayama.

Upon leaving 'Little Kyoto', our bus took us to the big city of Nagoya where, on the last day, we visited Nagoya Castle and had meaningful technical tours of the Toyota Plant and the Toyota Commemorative Museum of Industry and Technology. We played Bingo on the bus. Everybody won and received gifts except for me. To be the only one losing the game, I myself felt lucky since I was presented with a traditional Japanese cookie as a consolation prize. We reached Tokai hotel after night had fallen. Everyone seemed to be hungry and it was the right time to have dinner. A well-served Japanese party in a big room welcomed us. That night, we experienced a great evening of eating and singing karaoke together. It wasn't until the following

morning that I realized that the hotel was located right on the beach. What a beautiful sunrise!

After our journey, one member of the trip kindly gave me a video clip from that special night. Now, whenever I see the pictures and the video, it always reminds me of our unforgettable



In front of Ainokura Folklore Museum, Shirakawa World Heritage site, Kanazawa City

trip, and the nice friends from different countries that I got to know.

Thanks to the organization of the Graduate School of Engineering and the very kind guidance of the Japanese people who traveled with us, especially Professor Toshiro and Doctor Tanaka, we could experience this trip. It was not simple like sightseeing but rather an experience of Japanese culture. Please don't miss the chance to catch this trip if you want to enjoy 'international friends in Japanese culture'.

Money, Sex, Fear (and why I came to Japan)



Paul James Smith

Doctor course student
Department of Urban Management
Graduate School of Engineering

I am often asked why I left Australia to come to study in Japan. Well, it is said that the three biggest motivators of human behavior are money, sex and fear. I think there is more than just a hint of truth in this wisdom. In the case of my seduction to the land of the rising sun, it would be foolish to dismiss the notions that money and sex played a role. They probably did. The Ministry of Education was at the time generously offering to support my studies, for which I continue to be extremely grateful, and it must be admitted that Japanese ladies are among the most beautiful women in the world.

But, let's not forget, we have post-graduate financial support back in Australia, and by no means are we in short supply of gorgeous women - so no, surely money and sex were not the decisive factors. In retrospect, it was fear that was the clincher. Yes, I was scared that if I stayed in Australia for much longer that I would go stale. Australia, often referred to as 'the lucky country', is indeed a wonderful place to grow up and live, but it had become my comfort zone, and I knew it was time to leave to seek stimulation and challenge somewhere new, where I could continue to grow as an individual.

Japan was the obvious choice as my new playground - for this is no ordinary country, but a dynamic nation that has over the last 50 years experienced one phenomenally strange ride. Recent history has turned it into a peculiar yet fascinating land of contradictions. Japan has become a futuristically-sexy high-tech nation coordinated by a society still rooted to the traditions of the past, a land where the geisha quarters of Gion are giving way to Starbucks cafes, a country influenced by the rigid ideals of the martial spirit and the simplicity and naturalness of traditional arts and yet fielding the blondest football team in World Cup history. Have the forces of globalization left Japan with an identity crisis? It seems only now that the country has found the time to stop and catch its breath, and is likely also wondering where this period of phenomenally rapid change has taken it. No wonder so many books have been written about Japan, it is a fascinating, if not peculiar place to be.

Japan's future promises not to disappoint either. As the government grapples with economic problems, as society learns to cope with its aging population, as the commercial sector peers over the horizon at rapidly expanding East Asian markets, and as this country that has renounced war as a sovereign right arguably finds itself on the verge of having to choose whether or not to again become the leading military force in the region, I can't help but wonder about what's in store over the next half century for this amazingly intriguing society. For those of us who fear change, this rapid transformation may be disconcerting. Me, I fear constancy.

If nothing ever changed, there'd be no butterflies - unknown

日本留学フェア(韓国)&日韓共同理工系学部留学生 推進フェアに参加して



田中 和人
元機械工学専攻 講師

【日本留学フェア】

日本留学フェアが2004年9月10日に釜山で、12日にソウルで開催されました。本フェアは、2004年4月に、日本育英会、日本国際教育協会、内外学生センター、国際学友会、関西国際学友会が合併して独立行政法人となった日本学生支援機構などの主催で開催されるものであり、日本への留学を希望する韓国の高校生や大学生などを対象にして、日本の各大学や専門学校、日本語教育機関がPRする場で、本年は146機関が参加しました。京都大学からは、留学生センター・河合淳子先生、留学生課・辻裕史専門職員と筆者が参加しました。オープニングセレモニーだけでも30分以上もある盛大なイベントであり、釜山会場1328名、ソウル会場2563名の来場者があり、日本留学への関心の高さを感じられました。

「どうしてもうちの子供を京都大学にいたいんです。」という親御さんから、「京都大学は国立大学だったのですか?」、「写真学科はありますか?」、「広告学科は?」と様々な方がブースを訪れましたが、皆熱心に質問されていました。噂に聞いていたとおり、日本以上に親御さんが熱心で、平日にもかかわらず両親そろって相談にみえる方もおられました。ただ、熱心な方からは、「京大のHPには必要な情報が何も書いていない。」「先生がたのメールアドレスが載っていないので問い合わせようがない。」「特別選抜の過去の試験問題をHPに公開して欲しい。」等の要望がありました。国際交流を進めるにあたって、英語のHPの充実が望まれるところです。メールアドレスに関しては、公開することによるデメリットに慎重になるあまり、公開に対して消極的な現状を改善し、アドレスの表示を画像化するなどして積極的に公開する必要があると思います。また、韓国においては京都大学の名前があまり知られていないことを目の当たりにして、今後優秀な留学生を確保するためにも、留学フェアへの参加をはじめとしてPR活動を積極的に行う必要があると感じました。

【2004年度日韓共同理工系学部留学生推進フェア】

日韓共同理工系学部留学生プログラムの推進フェアが2004年10月2日に慶熙大学(ソウル)で開催されました。このプログラムは2000年度から始まっており、1998年、当時の金大中大統領と小渕首相による日韓共同宣言に端を発するものです。韓国の高校卒業生を1年間の予備教育(韓国で6ヶ月、日本で6ヶ月)の後、日本の理工系の国立大学において学部学生として受け入れ、最先端技術・知識の習得を可能にするとともに、留学生交流を通じて日韓の相互理解を深める目的で進められています。現在、京都大学では、第1期生である4回生の5名をはじめ計21名が学んでおり、全国に500名程度の留学生が勉学に励んでいます。

本推進フェアは、第6期生となるべく選抜試験を受けた高校生が、何処の大学を希望するかを決めるために、日本の27大学から50名程度の国立大学関係者が説明に赴く場でありました。京都大学のブースには選抜試験合格者150名のうち成績の良かった30名程度が訪れ、工学部および農学部の各学科で学べる内容について熱心に質問していました。中には、「成績は悪かったのだが、どうしても京都大学に行きたい。」と嘆願する学生もあり、筆者は困りながらもうれしい面もありました。



日本留学フェアにて

国際交流日誌 (2004年8月1日～2005年1月31日)

9月30日(木) スtockホルム王立工科大学 Prof. Anders Hult
(Dean, Chemistry and Chemical Engineering) 他1名
留学生交流プログラムについて
10月13日(水) 平成16年度博士後期課程総合工学特別コース
ガイダンス
11月11日(木) 「電気系留学生パーティ」開催
11月15日(月) 中国科学技術部副部長(副大臣)他3名
学術に関する意見交換

11月15日(月)～17日(水)
特別コース見学旅行
(金沢、白川郷、高山、名古屋方面)
2005年
1月20日(木) 拠点大学学術交流事業VCCコーディネーター会議
(於 クアラルンプール)
1月20日(木) 拠点大学学術交流事業MOEコーディネーター会議
(於 京大)

The Committee for International Academic Exchange, Graduate School of Engineering, Kyoto University, 606-8501, Japan

Phone 075 753 5038 / FAX 075 753 4796

606-8501 京都市左京区吉田本町 京都大学工学研究科国際交流委員会