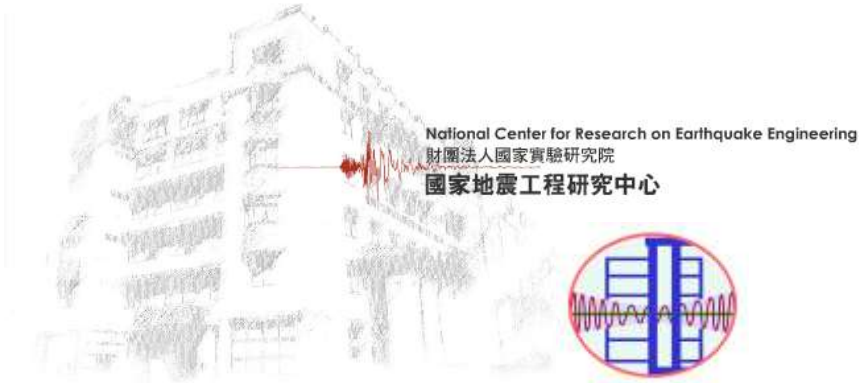
日本橋梁管理及柔性計算工程應用專題演講研討會

Seminar on Bridge Management in Japan and Applications of Soft Computing in Structural Engineering



◎主持人及講員◎（依照出場序）

張國鎮	國家地震工程研究中心主任
	國立台灣大學土木工程系教授
宋裕祺	國立台北科技大學土木工程系教授
	國家地震工程研究中心橋梁組組長
Hitoshi Furuta	Professor, Department of Informatics, Kansai Univeristy, Takatsuki, Osaka, Japan

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敬邀

財團法人國家實驗研究院國家地震工程研究中心
10668 台北市大安區辛亥路三段 200 號

國家地震工程研究中心
National Center for Research on Earthquake Engineering

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主辦單位：財團法人國家實驗研究院國家地震工程研究中心
協辦單位：中華民國結構工程學會、中華民國地震工程學會
時間：102 年 12 月 20 日（星期五）
地點：國家地震工程研究中心 101 演講廳
費用：免費。
名額：預計 90 人。(額滿為止)
報名方式：即日起開始報名，請上網址 http://www.ncree.org.tw/
備註：本研討會已向行政院公共工程委員會申請技師換證積點，及公務人員終身學習護照相關證書。

◎宗旨◎

本次研討會由財團法人國家實驗研究院國家地震工程研究中心主辦，中華民國結構工程學會和中華民國地震工程學會共同協辦，邀請 Hitoshi Furuta 教授來訪進行兩場專題演講，講題分別為日本橋梁管理現況及柔性計算在工程之應用。

橋梁管理與維護課題隨著橋梁結構使用時間增加越顯重要性，Hitoshi Furuta 教授此次將針對日本橋梁現況及其橋梁管理系統進行介紹，分享日本橋梁管理與維護經驗，另外針對損壞道路路網分析、橋梁管理維護策略等高複雜度決策問題，Hitoshi Furuta 教授亦將介紹其沿用資訊技術和人工智慧的柔性計算方法於結構工程應用研究之實例與成果。

Hitoshi Furuta 教授長期致力之研究範圍主要為可靠度及最佳化分析方法應用於橋梁設計與維護管理，Hitoshi Furuta 教授此次訪台行程緊湊，特別安排於國家地震工程研究中心進行專題演講，將有機會直接讓與會者與 Hitoshi Furuta 教授進行互動討論，並提升台灣土木工程學界與業界在此研討議題之知識，並利用本次專題演講討論會進行台灣與日本相關研究議題之交流，有利未來雙邊研究合作發展。

日本橋梁管理及柔性計算工程應用專題演講研討會

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Agenda (議程)			
102 年 12 月 20 日(星期五) December 20, 2013 (Friday.)			
Time (時間)	Program (講題)	Speaker (講者)	Chairman (主持人)
08:50～09:10	Registration (報到)		
09:10～09:15	Welcome Address (歡迎致詞)	*Prof. K.C. Chang (張國鎮 主任)*	
09:15～10:30	**Bridge Management in Japan (日本橋梁管理)**	*Prof. Hitoshi Furuta*	*Prof. Y.C. Sung (宋裕祺教授)*
10:30～10:45	*Coffee Break (休息/茶水)*		
10:45～12:00	**Applications of Soft Computing in Structural Engineering (柔性計算於結構工程之應用)**	*Prof. Hitoshi Furuta*	*Prof. Y.C. Sung (宋裕祺教授)*

講者簡介		
姓名	**Hitoshi Furuta**	
所屬機構	**Department of Informatics, Kansai University, Osaka, Japan**	
職稱	**Professor**	

Interest Area: Applications of Structural Reliability and Optimization to Bridge Design and Maintenance

URL: unfortunately, there is no website written in English.

Short Biography: Dr. Hitoshi Furuta is a Professor in the Department of Informatics at Kansai University, Osaka, Japan. In 1980 he received his doctorate in Engineering from Kyoto University, Japan. Before joining Kansai University in 1993, he worked for eighteen years in the Department of Civil Engineering at Kyoto University. He was a Visiting Assistant Professor at Purdue University, a Visiting Scholar at Princeton University, and a Visiting Professor at the University of Colorado at Boulder.
His main areas of expertise are structural reliability, structural optimization, life-cycle cost analysis and design of bridge structures, and applications of soft computing including artificial intelligence, fuzzy logic, neural network, chaos theory, and genetic algorithm.

Hitoshi Furuta was Vice President of IFSA (International Fuzzy Systems Association), Chair of IFIP (International Federation for Information Processing) Technical Committee 7.5, Chair of the Task Committee on Load Specification in the Japan Society of Civil Engineers (JSCE), Chair of the Committee of Asset management in Japan Construction Consulting Association, Chair of the committee on Data Exchange Format for Highway Construction in Japan Highway Corporation, Board Member of JSCE, President of Kansai Chapter of JSCE, Chief Director of International Affair Division of JSCE, Chair of Committee of Structural Engineering, JSCE, President of Kansai Chapter of Japan Society for Fuzzy Theory and Intelligent Informatics, President of International Association for Structural Safety and Reliability, and Currently Vice President of International Association for Life-Cycle Civil Engineering

He received IABMAS Senior Award, Hanshin Expressway Award, etc.

He is the author or co-author of over 300 refereed publications, including books, book chapters, journal articles, and papers in conference proceedings. Furuta is also the co-editor of three books published by ASCE, Balkema, and Springer Verlag and editorial board member of several international journals. Additionally, he has chaired and organized several international structural engineering conferences.

Bridge Management in Japan

Hitoshi Furuta
Professor
Department of Informatics
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ABSTRACT

Bridge maintenance is becoming more and more important all over the world. In Japan, a lot of highway bridges have been constructed over past 50 years, whose 40 % bridges were constructed during the so-called highly developing period. In the coming ten years, the number of bridges more than 50 years old becomes four times of the present number, and further 10 years later it becomes 17 times. Most of these bridges are aging and suffering from damage, deterioration and environmental attack. The number of deteriorating bridges must increase in the near future.

This paper presents the current status of bridge maintenance and bridge management system. The outline of bridge management system is illustrated and defects and problems to be overcome are clarified, based upon the experiences in Japan. In Japan there are 150,000 bridges with spans of more than 15 meters are in use so that it requires an enormous budget to maintain them in satisfactory conditions. Furthermore, sufficient data, experienced maintenance engineers, special technologies, and good ordering system are needed.

In order to develop a bridge management system, the concept of Life-Cycle Cost (LCC) has been paid attention as a promising tool for the achievement of rational maintenance programs. The basic concept and advantage of LCC are discussed. Several suggestions are provided to realize a rational and economic maintenance program and to develop a practical bridge management system.

Applications of Soft Computing in Structural Engineering

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ABSTRACT

Recently, great attention has been paid to soft computing technology, because of its applicability and easiness of computation in engineering problems. This presentation introduces several applications of the soft computing in various real engineering problems. First, a new optimal restoration scheduling method is described, which was developed for damaged road networks by using Genetic Algorithm (GA). The method can propose an early restoration plan for lifeline systems after earthquake disasters. Here, two issues are focused on, the first of which is such an allocation problem that which groups will restore which disaster places, and the second is such a scheduling problem what order is the best for the restoration. In order to solve the two problems simultaneously, GA is applied, because it has been proven to be very powerful in solving combinatorial problems. However, road networks after earthquake disasters have an uncertain environment, that is, the actual restoring process should be performed by considering various uncertainties simultaneously. Therefore, GA Considering Uncertainty (GACU) was developed to treat various uncertainties involved.

Next, an optimal maintenance planning of bridge structures using multi-objective genetic algorithm is described, which can provide several practical scheduling candidates that the bridge owner can select by considering the situation and constraints.

A structural health monitoring system is introduced, which can treat the changes of systems and environments. By adapting to the environment, it is not necessary to prepare any previous knowledge and examination for the underlying structures and environment. In other words, it is not necessary to use a precise modelling and analysis method before conducting the health monitoring. In the system, both Adaboost and GMDH (Group Method of Data Handling) are used for the learning and compared by paying attention to the accuracy of prediction.

In order to establish a rational maintenance program for structures, it is necessary to collect enough data about the material and structural characteristics and to evaluate the structural damage in a quantitative manner. However, it is difficult to avoid the

subjectivity of inspectors when visual data are used for the evaluation of damage or deterioration. The method can evaluate the damage condition of existing structures by using the visual information given by digital photos. It is based upon such new technologies as image processing, photo-grammetry, pattern recognition, and artificial intelligence.