International Symposium of Young Researchers for “Advances in Disaster Responses to Seismic Hazards in Tall Buildings using Innovative Sensing Technologies”

December 18-19, 2012
DPRI, Kyoto University, JAPAN

Sponsor:
Disaster Prevention Research Institute (DPRI),
Kyoto University

DPRI-KU

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京都大学
KYOTO UNIVERSITY

Disaster Prevention Research Institute, Kyoto University
Gokasho, Uji
Kyoto 611-0011, JAPAN

November 1, 2012

Dear International Symposium Participant,

I would like to extend my personal welcome to DPRI, Kyoto University and to the International Symposium by Young Researchers for "Advances in Disaster Responses to Seismic Hazards in Tall Buildings using Innovative Sensing Technologies". You have been specially invited in the symposium due to your leadership position to the structural health monitoring, hazard mitigation and sensing fields. I am personally very excited by the intellectual challenges we will explore together against seismic hazards in tall buildings. The agenda of the symposium will provide excellent opportunities for sharing the underlying issues for enhancing the resiliency of our buildings and our community. Certainly, the borderless exchanges of ideas will result in the creation of an empowered research community engaged in the mitigation of seismic hazards.

A successful symposium is one that yields outcomes of high intellectual value and broad social impacts. In that sense, participants are encouraged to actively participate in discussions and in process of developing a symposium's resolution as one of most valuable outcomes of the symposium. This is a unique opportunity to listen voices from broad engineering fields and different counties. Our success during this symposium will depend on the ideas and enthusiasm brought by the participants. In that sense, I would sincerely request the participants to be prepared for open discussions. I am confident that you will have the chance to enjoy this genuine opportunity and contribute to making the symposium fruitful.

I would like to express my sincere appreciation to the invited speakers and administrative staff of the DPRI for making this opportunity possible.

Finally, I really look forward to working with you in Kyoto.

Sincerely yours,

Masahiro Kurata, Ph.D.
Assistant Professor and Program Coordinator, Division of Earthquake Research
Disaster Prevention Research Institute (DPRI), Kyoto University
Email: masahiro.kurata.5c@kyoto-u.ac.jp
http://www.steel.dpri.kyoto-u.ac.jp/en/index.html

INTERNATIONAL SYMPOSIUM BY YOUNG RESEARCHERS FOR
"ADVANCES IN DISASTER RESPONSES TO SEISMIC HAZARDS IN TALL BUILDINGS USING INNOVATIVE SENSING TECHNOLOGIES"

Room 301, Research Center for Disaster Reduction Systems (DPS), DPRI, Kyoto University
December 18-19, 2012

Tier 1	**Sensing Technology for Damage Assessment**
Tier 2	**Structural Integrity Assessment and Decision Making**

AGENDA

2012 / 12 / 18 (Tue)

8:50–9:10	**Registration & Morning Coffee (Room 301)**
9:10–9:30	***Opening Remarks*** Masahiro Kurata, DPRI @ Kyoto University Seismic Hazards in Tall Buildings and Post-Earthquake Damage Screening
9:30-9:45	***Invited Talk*** Kohei Fujita, Kyoto University Web-based Autonomous Damage Detection
9:45–10:25	***Invited Talk*** Yang Wang, Georgia Institute of Technology Structural Monitoring and Control with Wireless and Mobile Sensors
10:25–11:05	***Invited Talk*** Yoshihiro Nitta, Ashikaga Institute of Technology Payload Projects for Structural Health Monitoring
11:10–11:40	***Facility Tour*** Po-Chien Hsiao, Li Xiaohua, and Mayako Yamaguchi, DPRI @ Kyoto University
11:40–12:40	**Lunch (Cafeteria)**
12:40–13:20	***Invited Talk*** Toru Tanaka, Masayuki Kimura, Murata Manufacturing Co., Ltd. Structure health monitoring using MEMS inertial sensor -
13:20-14:00	***Invited Talk*** Branko Glicic, Princeton University Global and Integrity Monitoring: Damage Detection and Localization using Fiber Optic Sensors
14:00–14:40	***Invited Talk*** Tomomasa Emoto, Texas Instruments Japan Ltd. Seismic Data Converters from Texas Instruments
14:40–15:00	**Coffee Break**
15:00–15:40	***Invited Talk*** Michihito Shiraishi, Shimizu Corporation Structural Health Monitoring for Early Recovery of Building Functionality and Serviceability after Earthquakes
15:40–16:20	***Invited Talk*** Chiho Ochiai, Kyoto University Traditional community-based disaster management in Hongu-cho: A case study from 2011 Typhoon disaster
16:20–17:00	***Invited Talk*** Daniele Zonta, Torento University Tall buildings, data monitoring and Bayesian epistemology

2012 / 12 / 19 (Wed)

8:50–9:10	**Morning Coffee (Room 301)**	
9:10–10:15	***Panel Discussion*** Tier 1: Sensing Technology for Damage Assessment Moderator: Yang Wang, Recorder: Kohei Fujita	
10:15–10:30	**Coffee Break (Room 301)**	
10:30–11:35	***Panel Discussion*** Tier 2: Structural Integrity Assessment and Decision Making Moderator: Branko Glisic, Recorder: Tracy Becker	
11:35–12:30	**Lunch (Cafeteria)**	
12:30–15:00	***Group Proposal Tier 1*** Moderator: Yoshihiro Nitta Recorder: Yundong Shi	***Group Proposal Tier 2*** Moderator: Daniele Zonta Recorder: Chiho Ochiai
15:00–15:20	**Coffee Break (Room 301)**	
15:20–16:30	***Resolution Making Tier 1*** Moderator: Yang Wang Recorder: Yundong Shi	***Resolution Making Tier 2*** Moderator: Branko Glisic Recorder: Chiho Ochiai
16:30–17:00	***Symposium Wrap-up*** Resolutions are presented by moderators of the group proposal sessions	
17:00–17:15	***Closing Remarks*** Masahiro Kurata, DPRI @ Kyoto University	
18:00–20:00	**Dinner (Nearby Kyoto station)**	

Notes:

- Moderators of panel discussion are asked to make a list of discussion items based on the invited talks in the first day.
- Resolutions from group proposal session are presented in the wrap-up session.
- For the group proposal and resolution making session, participants are tentatively assigned either to Tier 1 or Tier 2 as follows.

Tier 1: Sensing Technology for Damage Assessment (Panelist / Moderator / Recorder) Wang, Nitta, Kimura, Emoto, Fujita (General Participants) Tanaka, Shi, Li, Luo, Enomoto, Minegishi, Nishi
Tier 2: Structural Integrity Assessment and Decision Making (Panelist / Moderator / Recorder) Zonta, Glicic, Ochiai, Becker (General Participants) Nozawa, Hayashi, Tang, He, Taniguchi, Yamaguchi, Fukihara

BIOGRAPHIES AND ABSTRACTS

Organizer

Masahiro Kurata
Assistant Processor
Disaster Prevention Research Institute, Kyoto University

Masahiro Kurata is an Assistant Professor of the Division of Earthquake Hazards, the Disaster Prevention Research Institute at Kyoto University. Dr. Kurata completed his graduate studies at the Georgia Institute of Technology where he received his Ph.D. in Civil and Environmental Engineering in 2009 and conducted two-year post-doctoral research at University of Michigan. His current research interests are in the areas of post-disaster structural damage screening, self-diagnosable earthquake resistant system and sustainable seismic rehabilitation approaches for building structures. His work includes numerical simulations, large-scale testing using shake tables and development of autonomous structural monitoring system using advanced sensing technologies.

Title:
Advances in Disaster Responses to Seismic Hazards in Tall Buildings using Innovative Sensing Technologies

Abstract:
Investigating damage in earthquake-affected buildings involves intensive labor with structural engineers registered as investigators visit each building one by one. With the current visual-based approach, the required time for completing damage screening after a large earthquake in the Tokyo metropolitan area is estimated to be more than a month. Such downtime as consequences of damage in large and important structures (e.g., bridges, schools, and high-rise buildings) can result in long-term economic losses and impact to social activities that hinder the rapid recovery of earthquake-affected communities. A stand-alone sensor network deployed to a structure for monitoring its response, commonly called as a Structural Health Monitoring (SHM) system, has a strong potential for increasing the speed in the damage screening process and for providing objective information based on data. However, the real-life application of the SHM system for the damage assessment of structures is still limited to important infrastructures for two major reasons: 1) the large cost and amount of labor of sensor installation as well as issues associated with long-term maintenance of sensors; 2) the unknown impact on decision making process and management of structures in natural hazards and fatigue-related deteriorations. In DPRI, current research efforts focus on the development of wireless local damage detection techniques that provide quantitative information of the location and degree of damage in structural members. Sensor configurations and damage detection algorithms were verified through a series of modal shaking and shake table tests using a large-scale five story steel-frame testbed. The needs and the latest achievements in local damage screening technologies are presented along with the future application of techniques to tall buildings.

Invited Speakers

Branko Glicic
Assistant Processor
Department of Civil and Environmental Engineering, Princeton University

Branko Glišić received his degrees in Civil Engineering and Theoretical Mathematics at University of Belgrade, Serbia, and Ph.D. at the EPFL, Switzerland. His thesis focuses on the development of fiber optic sensors for particular applications, and characterization of concrete at very early age. He was employed at SMARTEC SA, Switzerland, where he was involved in research and engineering at different levels of responsibility in numerous structural health monitoring (SHM) projects. Since February 2009 he has been employed as an Assistant Professor at Department of Civil and Environmental Engineering of Princeton University. His main areas of interest are SHM methods, advanced sensory systems, smart structures, SHM data management, and sustainable engineering. Prof. Glišić is author and co-author of more than hundred published papers, university and professional courses on SHM, and a book entitled "Fibre Optic Methods for Structural Health Monitoring" (2007). He is a member of ISHMII Council and editorial board of the ISHMII's newsletter "The Monitor", voting member of ACI Committee 444 on SHM, and an active member of several other professional associations (IABSE, IABMAS, ACSE, ISMA).

Title:
Global and integrity monitoring: damage detection and localization using Fiber Optic Sensors

Abstract:
Sustainable preservation of existing, and sustainable construction of new civil structures and infrastructure represent goals that are essential for future vitality of economy and prosperity of any society. However, realization of these goals is significantly challenged for the structures built in areas prone to natural hazards such as earthquakes, hurricanes, etc. Structural health monitoring (SHM) emerged in the last two decades as a novel multi-disciplinary branch of engineering, with promising potential to help reaching the above goals. Several SHM methods based on application of various sensing technologies combined with specific data analysis algorithms have been researched, developed and with more or less success applied to real structures. Fiber optic sensing (FOS) technologies have significantly evolved and have reached their market maturity during the last decade. The main widely recognized advantages of these technologies are high precision, stability, and longevity in long terms. But in addition to these advantageous performances, FOS technologies provided with long-gauge and truly distributed strain sensors, which led to the development of new transformative SHM methods based on these types of sensors. Using these methods it is possible to affordably instrument large areas of structure, enabling global, large-scale monitoring based on long-gauge sensors, or integrity monitoring based on distributed sensors. These two approaches are presented in details along with enabling FOS technologies, and illustrated with applications on buildings, bridges, and pipelines.

Chiho Ochiai
Assistant Processor
Graduate School of Global Environmental Studies of Kyoto University

Chiho Ochiai is an Assistant Professor in the Graduate School of Global Environmental Studies of Kyoto University, Japan. She has been working closely with the local communities nationally and internationally, including rural cities and villages in Japan and Switzerland. Her research interest is traditional community-based disaster management and its relation with local organizations such as fire volunteers, residents' association, neighborhood and local community.

Title:

Traditional community-based disaster management in Hongu-cho: A case study from 2011 Typhoon disaster

Abstract:

While many attentions have been given to the great eastern Japan earthquake and tsunami, massive typhoon disaster hit central part of Japan causing many death as well as damages to infrastructures and local society. In September 2011, several mountainous areas of Tanabe city in Wakayama prefecture were heavily affected as Typhoon no.12 slowly reached and caused torrential rain. One of heavily affected area was called Hongu-cho district (here after Hongu). In Kamikitayama village located 40km north east of Hongu, the amount of rainfall was 1652.5 mm in 72 hours, the highest record since the observations began in 1976.

At the time of the typhoon, the public support (local government or fire department) was restricted due to the limited manpower, lack of information, closure of the streets, and minutes changing situations. Furthermore, disaster research in the past revealed that warning is a social process endowed with personal meaning. There is no single public and single expectation of a uniform public response.

Even though people in Hongu experienced almost two-meter-high flooding and some communities are temporarily isolated by the landslide, there was no casualty. They coped with disaster by taking advantage of past disaster experiences, local knowledge and human relationship that has been established at daily lives. How did they manage the situation such as information sharing, evacuation activity, spending time together in the shelter? The presentation introduces the actions and reactions of officers and people at that moment, and explains the relation to their everyday life.

Daniele Zonta
Assistant Professor
Department of Civil, Environmental and Mechanical Engineering,
University of Trento

Daniele Zonta earned his PhD in Structural Mechanics at Bologna University in 2000, and worked as a Post-Doctorate researcher at the University of California, San Diego, in 2000-2001. Since 2001, he has been assistant professor at Trento University, where he teaches Structural Design and Structural Health Monitoring. His research activity includes: Bridge Management; Reliability Evaluation; Structural Health Monitoring; Sensor and Information Technology; all as applied to civil infrastructure. Dr Zonta is an active member of SPIE, SEM, IABMAS, where he serves on the SHM committee; he chairs the Memscon Series Workshops; he regularly organizes special sessions for the main conferences in the field (including the EWSHM/IWSHM series); he is a reviewer for most of the major Structural Health Monitoring journals. In past years, Dr Zonta has been a visiting scholar at the University of California San Diego, Princeton University and University of Michigan. He has published more than a hundred technical reports in international journals.

Title:
Tall buildings, data monitoring and Bayesian epistemology

Abstract:
An important challenge in the application of structural health monitoring (SHM) in civil engineering is the creation and implementation of algorithms for automatic and reliable detection of unusual structural behaviour. Here we relate a true story that shows how Bayesian logic provides a rigorous mathematical tool that an engineer can use to help update his judgment on the state of a building. The protagonist of the story is ‘Branko’, who in year 2001 was in charge of data analysis for a 19-storey building instrumented with interferometric fiber optic strain sensors. The acquired data over the years has convinced Branko that there is settlement at one of the column foundations, in contrast with his initial expectation. This judgment matured gradually not only based on the data, but also on information from a design engineer. In this work we show how Bayesian logic can allow effective blending of field knowledge and SHM results. We show how the whole cognitive process followed by Branko can be reproduced using such logic. In particular, we discuss to what extent prior knowledge and inspection can alter the perception of the building status, otherwise based solely on instrumental data.

Kohei Fujita
Assistant Professor
Department of Architecture and Architectural Engineering, Kyoto University

Kohei Fujita is an Assistant Professor of the Department of Architecture and Architectural Engineering at Kyoto University. Dr. Fujita completed his graduate studies at Kyoto University where he received his Dr. Eng. in structural engineering in March, 2012. He is at the current position since October, 2012 after completing 6-months research experience as a JSPS post-doctoral researcher at Disaster Prevention Research Institute (DPRI), Kyoto university. He received his B.S. degree in Architecture and M.S. degree in Urban and Environmental Engineering, both from Kyoto University. His areas of expertise are robust building design, structural health monitoring, and optimal damper design.

Title:
Development of Web-based Autonomous Damage Detection System

Abstract:
Making a judgment call on whether to continue activities in buildings or to evacuate involves large uncertainties and subjective decision making after a severe earthquake. From the point of view of post-earthquake damage screening, a practical structural health monitoring (SHM) system should determine the degree of structural damage as quickly as possible. However, it may be a hard task to detect local damages in the scheme of conventional SHM. In this invitation talk, a smart cyber-based SHM system for autonomous structural integrity assessment is presented which can provide a quick evaluation of structural status. In the proposed system, the large amount of data acquired by the sensing network are automatically stored and processed to extract damage feature using an associated cyber infrastructure with a PostgresSQL relational database and embedded local damage detection algorithm based on the changes in internal force distribution, and quickly present results in a PHP-based SHM web-viewer. The proposed cyber-based SHM system is installed to a scaled 5-story testbed steel frame, which can replicate local damage (i.e., yielding and fractures) in beams and columns. The performance of the developed system is verified through the shake table testing under ambient loading and minor aftershock earthquakes.

Michihito Shiraishi
Research Engineer
Shimizu Corporation

Michihito Shiraishi is a Research Engineer of Shimizu Corporation. With a B.E. in architecture and an M.E. degree in architecture and civil engineering Civil Engineering awarded by Waseda University. In 2006 and 2007, he was a visiting scholar of LIST lab (conducted by Dr. Jerome P. Lynch) in University of Michigan. His areas of expertise are structural health monitoring, building functionality, and business continuity planning.

Title:
Structural health monitoring for early recovery of building functionality and serviceability after earthquakes

Abstract:
Structural health monitoring (SHM) is a technology to assess structural condition based on information from sensors installed in buildings, so it has been expected to utilize for early recovery of the building functionality and serviceability. In Japan, effectiveness of the SHM are firstly pointed out at the Southern Hyogo prefecture earthquake in 1995, and attracted widely attentions as a technology which can be used effectively to the BCP (business continuity planning) at the Mid Niigata Prefecture Earthquake in 2004. Then, under the current circumstances of activated seismic activity around Japan after the 2011 off the Pacific coast of Tohoku Earthquake, the importance of the SHM has much more increased.
Based on these backgrounds, over a decade-long research and development for the SHM by Shimizu Corporation will be reviewed in this presentation and some case studies of its operation results in the 2011 Tohoku Earthquake will also be discussed. Then, as a research activity for the future SHM system, just started the five-year special research project for urban disaster mitigation funded by MEXT (2012-2016) will be introduced. In this project, the next-generation SHM prototype system which has hundreds of new-type sensors and corresponding newly developed damage estimation methods will be installed in a series of large scale E-defense shaking table tests of high-rise buildings.

Tomomasa Emoto
General Manager
Distinguished Member of Technical Staff
Technology & Biz Interface, Texas Instruments Japan Ltd.

Tomomasa Emoto received BS and MS from Faculty of Science of Hiroshima University with Material Science. After working at Kyocera, he joined Texas Instruments Japan Ltd. in 1981 as Wafer FAB Diffusion Process Engineer. Emoto worked for Process Technology Development (Integration) for various semiconductor processes such as High Voltage MOS, RISC Processor, DRAM, CCD and Analog. From 2002, he is in current position to manage and out-reach technologies coordinating R&D and Manufacturing based on Customer Requirement. He is a member of IEEE, JSAP and IEICE. Emoto made 22 publications and presentations at industry and academy. He is participating to community activity for elementally and junior high school as well as science museum volunteer.

Title:
Seismic Data Converters from Texas Instruments

Abstract:
The catastrophic events due to earthquakes seriously impact on human life and global economic progress. It is because of this that TI is interested in positioning our technologies in ways that can improve early detection, notification, cost and design simplicity for Seismic systems. We are facing on the similar risks not only due to the earthquake but also with other nature hazard and aging degradation of infrastructure. The tragedy of cave-in at Sasago Tunnel of Chuo Express Way on Dec. 2 seriously shocked us. Due to Great East Japan Earthquake, TI Japan also experienced serious damage at 2 semiconductor factories at Miho (Ibaraki) and Aizu (Fukushima). In the first half of this presentation, the video of TI Japan factories will be shared how we could recover from this crisis. Needless to say, the preparations and quick actions to deal with the crisis are very important. In the second half, TI's Sensor Network approach to monitor seismic detection will be addressed. This is the effective tool to prevent/reduce human damage from the hazard with monitoring the vibrations of infrastructure such as buildings, bridges, tunnels, piping and so on. Today, TI is the leading supplier in Seismic Analog to Digital converter products for energy exploration and we believe that we are in a great position to offer solutions for early earthquake detection. An introduction to our technology and our system level approach will be outlined.

Toru Tanaka

Team Leader, Planning Sec.2 Sensor Products Dept. Sensor Products Div. Project planning, Murata Manufacturing Co., Ltd (Global Electronic Components Manufacturer)
PMI activities of M&A companies incl. former VTI Technology (MFI)

March 2011 – January 2012; Moduslink Japan kk (Global 3PL service provider) Sales Director, September 1999 – September 2005; Freelink Ltd., Holon, Israel (Start-Up Wireless Security Equipment Manufacturer) Manager of Operations, August 1999 – January 2009; CROW Electronic Engineering, Airport City, Israel, (Global Security Equipment Manufacturer) VP Engineering, April 1998 – August 1999; N.E.W. Ltd, Southampton, UK (Manufacturer of Infra-red sensors) Manager of Operations, April 1993 – August 1999; Nippon Ceramic Co., Ltd. Tottori, Japan (Manufacturer of various sensors) Overseas Sales, Europe

Masayuki Kimura

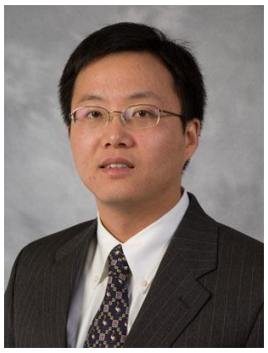
Field Application Engineer, FAE sec 4, Sensor Products Dept. Sensor Products Div., Murata Manufacturing Co., Ltd (Global Electronic Components Manufacturer)
Technical support, marketing activity and new business development of MEMS inertial sensors (ex-VTI technology products) in industrial, health care market

Oct 2008 - Oct 2011 Murata Electronics North America, Inc. Sensor products engineer, Device group, Marketing Div. Technical support, marketing activity and new business development of Piezo accelerometer, gyro, ultrasonic sensor, Pyro infrared sensor, magnetometer, SCM for those sensor products. Distribution of Authentech biometric sensor. 2005-2008 Murata MFG in Kyoto HQ, Piezo gyro application engineer for Digital Steel Camera image stabilization.

Title:
3D-MEMS inertial sensor technology for structure health monitoring

Abstract:
Murata Manufacturing (Murata MFG) and VTI Technologies Inc in Finland (VTI) merged in 2012. VTI main business is accelerometer and gyroscope for automotive, medical and industry market. Our unique 3D-MEMS (Micro-Electrol-Mechanical-System) technology has been achieved robustness, accuracy and cost-effectiveness. VTI has some seismic application experience like gas valve control at governor station, early warning system for slope disasters. On the other hand, Murata MFG has wireless communication module business mainly for mobile phone market. In these years, aging civil structure and building is controversy. We started to develop cost effective wireless sensor module for structure health monitoring.

Yang Wang
Assistant Professor
School of Civil and Environmental Engineering
Georgia Institute of Technology



Dr. Yang Wang is an Assistant Professor in the School of Civil and Environmental Engineering at the Georgia Institute of Technology. With a B.S. and an M.S. degree in Civil Engineering awarded by Tsinghua University (Beijing, China), he obtained a Ph.D. degree in Civil Engineering at Stanford University in 2007, as well as an M.S. degree in Electrical Engineering. Dr. Wang's research interests include structural health monitoring and damage detection, decentralized structural control, wireless and mobile sensors, and structural dynamics. Honored with a 2011 NSF Early Faculty Career Development (CAREER) Award, Dr. Wang is the author and coauthor of over 80 national and international journal and conference papers. He currently serves as an Associate Editor for the ASCE (American Society of Civil Engineers) Journal of Bridge Engineering.

Title:
Structural Monitoring and Control with Wireless and Mobile Sensors

Abstract:
Recent advances in wireless sensor networks offer promising alternatives to cable-based sensing and control systems in smart civil structures. With emphasis on wireless and mobile sensors, this presentation spans research in two major areas of smart structural technologies, i.e. structural health monitoring and structural control. On structural health monitoring, a prototype wireless structural sensing system has been successfully developed and validated in numerous field experiments. In addition, the wireless sensing research has been extended to some latest investigation on autonomous mobile sensors. The mobile sensors are made of miniature robots that carry wireless sensors and navigate on a structure. Furthermore, a battery-free wireless antenna sensor is developed for strain/crack measurement through radiofrequency technologies. With its convenience and low cost, the antenna sensor holds great potential for large-scale deployment. On structural control, wireless sensing methodology has been exploited for supporting real-time feedback control against earthquake excitations. The wireless sensing devices are capable of not only collecting and processing real-time sensor data, but also making control decisions and commanding structural control devices. Large-scale shake table experiments successfully validated the performance of the wireless control system, and the performance of decentralized optimal control algorithms.

Yoshihiro Nitta
Associate Professor
Architecture Course , Ashikaga Institute of Technology

Yoshihiro Nitta holds a B.S. in Architecture (Waseda University, Tokyo 1994), and M.S. and Dr. Engineering in Civil Engineering (Waseda University, Tokyo 1996, 1999). I joined the faculty of department of Architecture at Ashikaga Institute of Technology in 2005. I was the visiting scholar at University of Illinois at Urbana-Champaign in 2004 and served as a research associate at Waseda University from 1999-2003.
I have research interests in the areas of structural control and structural health monitoring. My research activity is mainly focused on the Structural Health Monitoring by utilizing smart sensors and inspection robots. Recently, our research group has conducted payload projects for structural health monitoring by using E-defense facilities.

Title:
Payload Projects for Structural Health Monitoring

Abstract:
Our research group have had conducted several payload projects of the structural health monitoring utilizing the developed smart sensors and inspection robot.
The payload projects for the developed smart sensors are two experiments of the autonomous-decentralized damage detection by utilizing E-Defense shaking table facilities. One is the damage detection scheme for beam-to-column joints by using full-scale steel model building. The main purpose of this experiment utilizing full-scale steel model building is to investigate the effectiveness of the several kinds of dampers during the long period earthquakes. The other is the damage detection scheme for the resisting prestressed concrete wall. The main purpose of this experiment of prestressed concrete building is to evaluate the performance of resisting prestressed concrete wall. The obtained results from these projects indicate the proposed scheme will be able to detect the damage on real time without any complicated calculations. The payload projects for the inspection robot are the experiment of the damage assessment methodology for the ceiling elements by using the shaking table facilities. The main purpose of this shaking table experiment is to investigate the effectiveness of the developed earthquake resistance elements. The result of this payload project indicate the inspection robot will provide useful information for conducting more highly detailed structural health monitoring.
These successful results of the payload projects indicate the payload project can advance the adaptation of innovative structural health monitoring technologies. And result from payload project also can serve as proofs of concept and technologies thus enable faster acceptance in practice.

General Participants

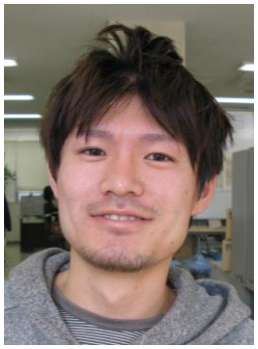
Kaede Minegishi
Master Student
Graduate School of Engineering, Kyoto University

Kaede Minegishi is an Undergraduate Student of the Division of Earthquake Hazards, the Disaster Prevention Research Institute at Kyoto University. Ms. Minegishi graduated Shimizuhigashi High school and entered Kyoto University in 2009. She just started her research in last September and be working at her graduate thesis. Her research subject is damage sensing system for steel building structures and her advisor is Dr. Kurata. Her work includes full-scale testing of a beam-column connection. She also works on making PowerPoint slides of soil liquefaction to lecture for high school students as part of Reduce Disaster Project. She belongs to Kyoto University Cycling Club and traveled around Turkey for a month with her mountain bike.

Kazuhiro Hayashi
JSPS Research Fellow
Disaster Prevention Research Institute, Kyoto University

He received the B.S. degree in 2006, the M.S. degree in 2008 and Ph.D. degree in 2011 from Setsunan University, Osaka, Japan. His areas of research interest are development of innovative composite structural system using ultra-high strength steel, design formula of a steel encased reinforced concrete column of non-symmetric cross section and development of earthquake resistant reinforcement method of steel structural building.

Kei Fukihara
Master Student
Graduate School of Engineering, Kyoto University



Kei Fukihara is an under graduate fourth year student and working towards graduation at Nakashima lab in Kyoto University. He researches in steel shear wall with X shaped links. By checking the deformation of those links, we can know magnitude of damages of buildings. He is enjoying his research and his life in Nakashima lab.

Liusheng HE
Ph.D. Student
Graduate School of Engineering, Kyoto University

Liusheng HE received his B.S. from Dalian University of Technology, China, in 2008, and M.S. from Tongji University, China, in 2011. He is currently working towards his Ph.D. at DPRI of Kyoto University, pursuing research in steel slit wall dampers with embedded structural condition assessment capability.

Mayako Yamaguchi

Master Student
Graduate School of Engineering, Kyoto University

She entered to the master course of architectural engineering after she graduated from Kyoto university undergraduate course this March. She is now taking classes of structural engineering and doing research under the guidance of Dr. Kurata, in Dr. Nakashima laboratory. Her research topic is 'Post-Earthquake Damage Screening of Steel Buildings using Model-Based Damage Pattern Classification'. She wrote undergraduate thesis paper and did presentation in AIJ, IBSML, and also attended to the summer course about model validation and simulation in Bauhaus university, Weimar. She is now working on the analysis of shaking table test using 5 story steel frame, and studying about machine learning algorithm.

Po-Chien Hsiao

JSPS Research Fellow
Disaster Prevention Research Institute, Kyoto University

Po-Chien Hsiao received his Ph.D in 2012 from University of Washington at Seattle, WA, after he received his M.S. and B.S. from National Taiwan University at Taipei, Taiwan. Currently, he works in Disaster Prevention Research Institute at Kyoto University as a Japan Society for the Promotion of Science (JSPS) postdoctoral fellow. His research interests combine experimental and analytical investigations to help develop the tools and understanding necessary for steel structural system design to resist the forces of earthquakes and other hazards.

Ryosuke Nishi

Master Student
Graduate School of Engineering, Kyoto University

Ryousuke Nishi is an undergraduate student in Kyoto University. He is a member of Nakshima laboratory. Now he is researching about the rocking system by using the concrete filled tube column which is made of high strength steel and tendon. His first test will start soon. Before his test he simulates his spacemen by using finite element analysis. His work is only this one. Then, introduce what he did in the university. He joined the field hockey club and he often go to part time job to teach some high school students.

Ryusuke Enomoto

Master Student
Graduate School of Engineering, Kyoto University

Ryusuke Enomoto received the B.S. degree in 2011 from Kyoto Institute of Technology in Japan. I am a graduate student at Kyoto University. My areas of research interest are development of innovative steel structural system using CFT with ultra-high strength steel, numerical simulation on the rocking and self-centering of building under strong earthquakes.

Takashi Nozawa

Research Fellow

Disaster Prevention Research Institute, Kyoto University

He received the B.S. and M.S. degrees from Tokyo University, in 1986 and 1988, respectively. He joined Kajima Co. Ltd. in 1988. From 2004 to 2012 he was a Chief Research Engineer of Kajima Technical Research Institute. Since 2012, he has been a Research Fellow of DPRI.
He has done the following studies:

- Estimation of subsurface structure by microtremor
- Identification of velocity structure by seismic records observed in the vertical array
- Forced vibration test and analysis of real structures
- Change of response characteristics based on earthquake observation records

He is now mainly engaged in the project of Maintenance and Recovery of Functionality in Urban Infrastructures. His current research interests include Seismic Soil Structure Interaction and Structural Damage Identification using Vibration Data.

Tracy Becker

JSPS Research Fellow

Disaster Prevention Research Institute, Kyoto University

Tracy Becker is a Japanese Society for the Promotion of Science Postdoctoral researcher at the Disaster Prevention Research Institute at Kyoto University. She received her BS in Structural Engineering from University of California, San Diego followed by her MS and PhD in Structural Engineering, Mechanics and Materials at University of California, Berkeley. She is a member of the International Committee of JSSI (Japanese Society of Seismic Isolation) and a member of EERI. Her research has focused on the behavior of seismically isolated infrastructure, from detailed modeling of isolation bearings to global system performance utilizing large scale dynamic testing. Her general interests include hazard mitigation, performance-based design, laboratory testing and high-performance structural technologies.

Xiaohua Li

Ph.D. Student

Graduate School of Engineering, Kyoto University

Xiaohua Li is a Ph.D. candidate at the Disaster Prevention Research Institute at Kyoto University. He received his BS in Civil Engineering from Xiangtan University, China followed by his MS in Earthquake Engineering from Institute of Engineering Mechanics, China Earthquake Administration. His current research focuses on piezoelectric sensing-based local damage detection for steel structures. His general interests include Bayesian model updating, real structure modal analysis, buildings' stiffness identification, and smart sensing technologies.

Xuchuan Lin

Research Fellow

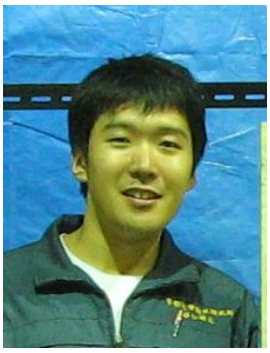
Disaster Prevention Research Institute, Kyoto University

He received the B.S. degree in 2007 and the M.S. degree in 2009 from Tsinghua University, Beijing, China, both in Civil Engineering, and Ph.D. degree in 2012 from Kyoto University, Kyoto, Japan. His areas of research interest are development of innovative steel structural system using ultra-high strength steel, numerical simulation on the collapse of high-rise building under extremely strong earthquakes and seismic design of reinforced structures.

Yudai Taniguchi

Master Student

Graduate School of Engineering, Kyoto University



Yudai Taniguchi, Japanese, Two years of the master's course, I graduated from Kyoto University in March, 2011. And I am going to graduate from the master's course of Kyoto University in March, 2013. My research is energy dissipation and seismic design of slitted shearwalls restrained by wooden panels.

Yunbiao Luo

Ph.D. Student

Graduate School of Engineering, Kyoto University

Education

- Bachelor. Eng (Civil Engeering, Zhejiang University, China, 2005)
- Master. Eng (Structure Engineering, Southeast University, China, 2008)
- Engineering Doctor Course (Structure Engineering, Kyoto University, Japan, 2008~now)

General information

His research topic involves the development of applications of high performance new material in structures, including high strength fiber reinforced polymer in reinforced concrete structure and high performance fiber reinforced cementitious composite in steel structure.

Yundong Shi

Ph.D. Student

Graduate School of Engineering, Kyoto University

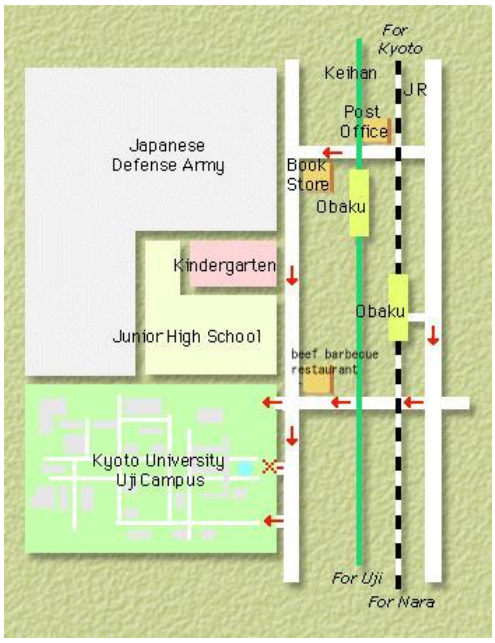
Yundong Shi received his B.S. degree in civil engineering from Tongji University at Shanghai, China in 2006. He then joined the graduate course in Tongji University and received his M.S. degree in structural engineering in 2009. From 2009 to now, he is a Ph.D.. student in Kyoto University, Japan in architecture engineering. His has been doing research of local buckling behavior of beam to column connection in steel portal frame, semi-active control and isolation structure, from his master course up to now. And he has been responsible for several different experimental programs, including dynamic test and static test. His current interests include the control theory, floor isolation system, and shaking table test.

Zhenyun Tang
Research Fellow
Disaster Prevention Research Institute, Kyoto University

Currently, Zhenyun Tang is a postdoctoral research fellow of DPRI, working on the damage detection of a full-size beam-to-column connection after pseudo static loading. He graduated from Beijing University of Technology (China) with a Ph.D degree in Civil Engineering in 2012. As a visiting Ph.D student, Zhenyun Tang worked in University of Bristol (UK) for one year and half. Before getting his Ph.D degree, Zhenyun Tang has worked on shaking table control and real-time substructuring testing method for five years, in charge of two projects supported by National Science Foundation of China and the European Commission's Seventh Framework respectively. Based on these works, 13 papers and 2 patents have been published. Because of that, Zhenyun Tang got the 'Liu Huixian Earthquake Engineering Scholarship award' in 2011 and 'Beijing outstanding graduates award' in 2012.

Access to DPRI @ Uji Campus, Kyoto University

〒611-0011 Gokasho, Uji ,Kyoto



Direction to Uji Campus

Keihan line
「Keihan Oubaku」→Walking about 6 minutes

JR Nara line
「JR Oubaku」→ Walking about 6 minutes
（JR Kyoto → JR Oubaku about 20 minutes）

Symposium Site Information

Research Center for Disaster Reduction Systems (DPS)
防災研究所　連携研究棟
3rd floor, Room 301 (large seminar room)
3 階 301 号室(大セミナー室)

1. Main Building (E building、S building)
2. Boundary Layer Wind Tunnel Laboratory
3. Wind Tunnel Laboratory
4. Research Center for Earthquake Prediction (RCEP)
5. Research Center for Disaster Reduction Systems (DRS)
6. Earthquake Response Simulation Laboratory
7. Full-Scale Steel Structure for Filed Observation
8. Strong Motion Observation Test Site
9. Garage
10. Electro-magnetic Shaking Table Laboratory
11. Geotechnical Centrifuge Center
12. UNITWIN Headquarter
    Research Centre on Landslides
13. Workshop
14. Obaku plaza(Kihada hall)