

International Seminar of "NIT, Gifu College" and Partner Universities  
– Environmental Sustainability, Disaster Prevention and Reduction,  
and Engineering Education –  
Gifu, Japan (March 18<sup>th</sup> – 19<sup>th</sup> 2018)

# Environmental Sustainability, Disaster Prevention and Reduction, and Engineering Education

## PROGRAM BOOK



# ESDPR&EE2018

Organized by  
National Institute of Technology,  
Gifu College (Japan)

# ESDPR&EE 2018

## *Preface*

In November 2011, GNCT (Gifu National College of Technology; currently, Gifu College, National Institute of Technology: NIT, Gifu, Japan) and ITB (Institut Teknologi Bandung, Indonesia) concluded Academic Exchange Agreement. Since then, we, FCEE (Faculty of Civil and Environmental Engineering) of ITB and GNCT, have built up our mutual understanding of research and education at both organizations. Based on the understanding, FCEE of ITB and GNCT and the other two NCTs of Toyota and Numazu, Japan agreed to open a joint seminar entitled “Environmental Sustainability and Disaster Prevention” on November 21, 2013 as an extension of the International Conference SIBE 2013 hosted by FCEE, ITB for November 19 and 20, 2013. “Environmental sustainability” and “disaster prevention” are the two major issues to which mega cities in Indonesia and Japan are facing. The first joint seminar tackling these two issues attracted more than 150 participants including graduate students of ITB, and successfully elucidated problems to be solved. After that, the joint seminar was held 4 times in Indonesia until 2016.

Up to now, Gifu College has concluded exchange agreements with 13 universities including three universities in Vietnam; Hanoi University of Science and Technology, Hanoi Architectural University, and Mien Trung University of Civil Engineering.

This seminar is the first international seminar by Gifu College, NIT, to expand the scope of topics and participating schools. The seminar will discuss the following topics: 1) urban planning focusing on the co-benefit of air pollution abatement and reduction of greenhouse gas emission, the optimal urban traffic system, and the energy recovery from waste treatment system, 2) management of urban water problems focusing on the flooding control, the waste water treatment and water pollution control, and the protection of coastal environment, 3) urban infrastructure resilient against seismic disaster focusing on the steel-concrete structures, the soil foundation, and the residential buildings, and 4) engineering education and collaborative research with partner universities.

We are very much pleased to have this seminar (ESDPR&EE2018) to be held in Gifu, Japan on March 18-19, 2018. We hope that this seminar would make our research collaboration broaden.

March 3, 2018

**Prof. Yoshito Itoh, Dr. Eng.**

President, Gifu College, National Institute of Technology, Japan.

## ESDPR&EE 2018

### *Contents*

#### **【Keynote】**

- K1 'Smart City Design' for Enhancing Sustainable Innovations in Developing Countries  
*Ikuo Sugiyama*
- 
- K2 Realizing Damage Mitigation and Early Recovery, Clarifying Bottlenecks in Society, and At-tempting to Build a System of Cross-Organizational Cooperation.  
*Nobuo Arai*
- 

#### **【Oral】**

- O1 Evaluation of Quality and Toxicity of River Water Receiving Industrial Wastes in Tributary of Citarum River West Java, Indonesia  
*Indah R S Salami, Diniyah T Nurfatimah, Dea Amalia, Tika Maulini, Dea Putri, Fazani Az-Zahra, Asep S Setiyawan, Windya Wardhani, and Dwina Roosmini*
- 
- O2 Low Flow Trend in Upper Citarum River Basin  
*Arno Adi Kuntoro, M.Syahril B.K. & Enung*
- 
- O3 Sustainable water resources management under climate change conditions for Ba river basin in Vietnam  
*Thuong Duc LE, Huy Thanh VO*
- 
- O4 A Prototype of Power Control Hardware for Raspberry Pi to Extend Operation Time in Environment Monitoring  
*Fujisawa Tsutomu, Tay Wei Jie, Tajima Koji & Deguchi Toshinori*
- 
- O5 Building Detection of Computational Fluid Dynamics Algorithm for Air Pollutant Dispersion  
*Ubaidullah Selamat, Muhammad Hasbullah, Kahar Osman & Zahran Khudzari*
- 
- O6 Environmental sustainability and Low Carbon Development in Malaysia.  
*Chin Siong HO, Loon Wai CHAU, Gabriel Hoh Teck LING*
- 
- O7 Numerical Simulation of Local Wind and Air Pollution Distribution over Java Island, Indonesia  
*Asep Sofyan*
- 
- O8 Ethanol production from the conversion of palm oil mill effluent by anaerobic process: Influence of iron (II) addition for acidogenic product formation  
*Marisa Handajani, Andri Gumilar & Mindriany Syafila*
- 
- O9 Assessment of Domestic Material Consumption for Sustainable Consumption and Production in Uzbekistan  
*Ozoda Yuldasheva, Naohiro Goto & Guido Sassi*
-

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Gifu, Japan (March 18<sup>th</sup> – 19<sup>th</sup> 2018)

- O10 Appling to the Stability Problems in Geotechnical Engineering using Rigid Plastic Finite Element Analysis  
*Kazunori Mizuno*
- 
- O11 Influence of spatial autocorrelation length of corroded thin-walled member thickness on ultimate compressive strength  
*Naohiko WATANABE, Masato SUZAKI & Masafumi TANAKA*
- 
- O12 Study on Compressive Strength Characteristic and Aging of Flow Value of Geopolymer Mortar with Fly Ash as Active Filler  
*Toshitsugu Inukai, Ashidmaa Batsuuri and Asaka Sekiya*
- 
- O13 Weakening of Reinforced Concrete Frame Cracked by Construction Stage subjected to Seismic Loading  
*Le Huu Thanh & Trinh Xuan Vinh*
- 
- O14 The Influence of Masonry Infills on the Seismic Response of Reinforced Concrete Frame Structures according to Modern Conception  
*Phan Van Hue, Nguyen Le Ninh*
- 
- O15 Development of an automatic defect inspection system for civil infrastructure based on computer vision technologies  
*Cuong Nguyen Kim, Son Quang Le, Kei Kawamura, Masatoshi YOSHIZAKI*
- 
- O16 Actual condition of support to foreign residents in disaster -Case study of Fukui prefecture-  
*Akemi EMOTO*
- 
- O17 Development of Smartphone Applications for Gifu Prefecture Disaster Prevention Information Systems  
*Yasuyuki Hirose*
- 
- O18 Methods for the assessment of the seismic vulnerability of the building stock project  
*Bakhrom Tulaganov, Prof. Dr. A.A. Khodjaev*
- 
- O19 Educational Effect of the Project Based Learning “Co+work”  
*Yoshihiro Kajimura, T. Hiraishi and Active Learning Center*
- 
- O20 Development and Application of an English Textbook Optimized for Technical College Students  
*KAMEYAMA, Taichi, SUGAHARA, Takashi & SATAKE, Naoki*
- 
- O21 Active Learning Strategy in NIT, Gifu College  
*Nobuyuki Ogawa, Tetsuro Tokoro & Yoshito Itoh*
- 
- O22 Development of environmental manipulation Device for severely handicapped children  
*Taichiro Imada, Usui Luke Yuya*
-

**International Seminar of “NIT, Gifu College” and Partner Universities  
– Environmental Sustainability, Disaster Prevention and Reduction,  
and Engineering Education –  
Gifu, Japan (March 18<sup>th</sup> – 19<sup>th</sup> 2018)**

- Analysis of Flow Characteristic at stent strut configuration in Patent Ductus Arteriosus
- O23 *Ishkrizat Taib, Kahar Osman, Ahmad Zahran Khudzari, Muhammad Ikhwan Kori & Takahisa Yamamoto*
- 
- O24 Implementation of Japanese-style TVET in Malaysian Universities: Where the journey begins  
*Nafarizal Nayan, Nur Azam Mohd Napis, Wahid Razzaly, Abdul Manaf Hashim, & Ali Selamat*
- 

**【Poster】**

- P1 Solutions for attracting capital Investment on transportation Infrastructure at Vietnam  
*Tran Thi Quynh Nhu*
- 
- P2 Application of remote sensing to assess the flash flood characteristics of Ky Lo river basin in Phu Yen, Vietnam  
*Truc Thanh HO, Van Thi TRAN & Huy Thanh VO*
- 
- P3 High Performance Concrete using High Volume Fly Ash Content and Small Size Coarse Aggregate  
*Duc Vinh Bui, Thi Hai Vinh Chu, Thanh Hai Nguyen*
- 
- P4 An Experimental Apparatus with LED Photo Sensors Aimed at Promoting Students' Initiative  
*Takuya Kohno*
- 
- P5 Experiencing Activities as an Engineer through Overseas Internship  
*Kohei Aoki, Takuya Kohno and Akira Shimizu*
- 
- P6 Film Synthesis of Graphitic Carbon Nitride as a Photocatalytic Material  
*Hitoe Habuchi, Hiroaki Aoyama and Kazushi Yasuda*
- 
- P7 First results of the plasma vertical displacement event (VDE) and driven halo current in a tokamak DEMO reactor  
*Y. Shibata, S. Miyamoto, A. Matsuyama, N. Asakura, H. Tanaka, N. Ohno, Y. Sakamoto, V. Lukash & R. Khayrutdinov*
- 
- P8 UAV photogrammetry for topographic monitoring and river management system  
*Kiyoshi Wada, Motohiro Otsubo & Kyota Hashiguchi*
- 
- P9 Biological treatment of electronic industrial wastewater by mesophilic UASB reactor  
*Haruhiko SUMINO, Kampachiro URASAKI, Kanna KAWAGUCHI, Tsuyoshi DANSHITA, Takashi YAMAGUCHI, Kazuaki SYUTSUBO*
- 
- P10 ENERGY-BASED REDUNDANCY EVALUATION FOR TRUSS BRIDGES  
*Yoshinori Mizuno*
- 
- P11 The Possibility of Introducing Ridesharing in Regions with Low Population Density  
-Utility as a Means of Evacuation During Nuclear Disasters-  
*Mitsuaki Kawabata and Mitsuki Nakai*
- 
- P12 A Study on Comparison with Classical Mechanical Phenomena by Peridigm Quasi Static Analysis  
*Ryoichi Shibata, Kohei Fujita*
-

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– Environmental Sustainability, Disaster Prevention and Reduction,  
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## ‘Smart City Design’ for Enhancing Sustainable Innovations in Developing Countries

<sup>1</sup>Ikuo Sugiyama

<sup>1</sup>Special Appointed Professor, Graduate School of Information Technology,  
Kobe Institute of Computing  
<sup>1</sup>Email:sugiyama@kic.ac.jp

**Abstract.** The aim of this paper is to define ‘Smart City Design’ as a process to improve our Quality of Life in developing and developed countries. The design is technically supported by Internet of Things(IoTs) and institutionally by Sustainable Development Goals(SDGs). IoTs are included in Industry4.0 with connecting things including human beings. SDGs started by United Nations in 2016 with 169 targets to be achieved by 2030. In former part of this paper, it is introduced why ‘Smart City Design’ can cause frequent innovations. The latter part is to explain why developing countries need ‘Smart City Design’ rather than developed ones. In conclusion, the sustainable innovations are made by the communications and collaborations with the help of IoTs and SDGs in the achievement process of ‘Smart City Design’.

**Keywords:** *Smart City, Innovation, developing country, IoTs, SDGs*

K1

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## Realizing Damage Mitigation and Early Recovery, Clarifying Bottlenecks in Society, and Attempting to Build a System of Cross- Organizational Cooperation

Nobuo ARAI<sup>1,2</sup>

<sup>1</sup> Disaster Mitigation Research Center, Nagoya University  
<sup>2</sup>Email: arai.nobuo@e.mbox.nagoyoa-u.ac.jp

**Abstract.** Developing and maintaining up-to-date Business Continuity Planning (BCP) helps municipalities and businesses ensure that they can continue to provide products and services during and after an emergency or a disaster. When working on such plans, the focus is typically confined to their own organization with response plans limited to a scope that they believe they can manage on their own. However, in actuality, no business or municipal operations are completely self-contained. To formulate effective BCP, information must be developed to identify the actual conditions necessary to keep a municipality or business up and running. Entities outside of a company that form its support system must be identified as they represent outside strengths and weaknesses. The optimum state for continuity under extraordinary circumstances cannot be determined until there is a clear picture of all limitations and weaknesses. To recognize the actual conditions of the society a business is operating in, holding regular *Speak Your Mind Sessions* (“Hon’ne-no-Kai” in Japanese) by the Disaster Mitigation Research Center, Nagoya University, part of the BCP program where information is shared privately offers opportunities to ascertain local and regional vulnerabilities that may affect continuity in severe conditions. It is essential to include regional and local government representatives and related companies as regional cooperation is essential to resume normal operations during restoration and recovery from disasters. And the Disaster Mitigation Research Center at the Nagoya University is conducting workshops to construct an optimal recovery strategy for Tokai area. In the case of a disaster, identifying regional hazards that could affect each participating entity and determining what issues could arise, makes it possible to then examine viable solutions.

**Keywords:** *BCP, chain of impact, infrastructure, regional cooperation, vulnerabilities*

K2

## Evaluation of Quality and Toxicity of River Water Receiving Industrial Wastes in Tributary of Citarum River West Java, Indonesia

Indah R S Salami<sup>1,2</sup>, Diniyah T Nurfatimah<sup>1</sup>, Dea Amalia<sup>1</sup>, Tika Maulini<sup>1</sup>,  
Dea Putri<sup>1</sup>, Fazani Az-Zahra<sup>1</sup>, Asep S Setiyawan<sup>3</sup>, Windya Wardhani<sup>4</sup>,  
and Dwina Roosmini<sup>1</sup>

<sup>1</sup>Environmental Management Technology Group, Faculty of Civil and Environmental Engineering,  
Bandung Institute of Technology, Jl. Ganesha 10 Bandung 40132

<sup>3</sup>Water and Wastewater Engineering Group, Faculty of Civil and Environmental Engineering,  
Bandung Institute of Technology, Jl. Ganesha 10 Bandung 40132

<sup>4</sup>Environmental Agency of Bandung Regency, Jl. Raya Soreang Km 17, Soreang  
Bandung 40912, Indonesia

<sup>2</sup>Email: indahrss@tl.itb.ac.id

**Abstract.** Citarum River was located in West Java Province, Indonesia, stretched out for around 269 km, passing through 13 municipalities, and was also very important water resource supporting almost 25 million populations. Sadly, the river was heavily polluted by domestic, agricultural, and industrial wastes. The pollution has been found in the upper stream segment of the river. The studies covered an evaluation of pollution levels and their effects on the environment in certain segment that was mainly affected by industrial wastes. Cikakembang River received 22 textile industrial discharges out of 56 textile industries in Majalaya District. River water samples were collected and analyzed for physical, chemical parameters such as temperature, pH, DO, TSS, TDS, COD, ammonium, nitrite, nitrate, phenol, and some heavy metals. The effect on the environment was represented by the measurement of acute toxicity (LC50) on *Daphnia magna*. The study showed that the pollution levels in the river fluctuated due to varied input of effluent discharges from industries. During night time the quantity and quality were much higher. The parameters found to exceed the government standards included TSS, COD, and phenol. The LC50 or TUa values were fluctuated and occasionally considered to be toxic. Toxicity of the river water itself was correlated with DO, COD, phenol, Pb, and sulphide ( $R>0.6$ ;  $p<0.05$ ). River water quality improvement was studied by phytoremediation, filtration, and aeration methods. Phytoremediation was not capable to reduce the pollutants successfully. Filtration method in laboratory scale removed some pollutants. Aeration in laboratory study was capable to reduce pollutants and the toxicity of the river water. The study suggested that river water quality improvement could be achieved by some techniques, however further evaluation on its application in field should be investigated.

**Keywords:** Citarum River, *Daphnia magna*, industrial wastes, quality, toxicity



## Low Flow Trend in Upper Citarum River Basin

Arno Adi Kuntoro<sup>1,2</sup>, M.Syahril B.K.<sup>1</sup> & Enung<sup>3</sup>

<sup>1</sup>Faculty of Civil Engineering and Environment, Institut Teknologi Bandung, Indonesia

<sup>3</sup> Civil Engineering Department, Politeknik Negeri Bandung, Indonesia

<sup>2</sup>Email: arnoak@ftsl.itb.ac.id

**Abstract.** Upper Citarum River Basin is located in West Java Province, Indonesia. With total area of 1718km<sup>2</sup>, this river basin is home for not less than 8 million people, with the most densely populated area is located in Bandung City, in the central part of the river basin. Population growth and economic activities in this area has leads to an increase of water demand, which is supplied from the rivers, lakes, springs, and groundwater within the river basin, as part of the hydrological system of the Upper Citarum River. Analysis of historical discharge data at Nanjung Station which is located in the most downstream part of the river basin shows a trend of Q80% dependable flow decrease. Within the observation period 1974-1988, Q80% decreased from 17.8m<sup>3</sup>/s to 12.1m<sup>3</sup>/s within 1990-2009. For future river discharge projection, Sacramento Catchment Model in used to simulate river discharge by using the data from climate change model of Coupled Model Intercomparison Project 5 (CMIP5) for RCP8.5 scenario. The results for simulation period of 2030-2050 shows that Q80% dependable flow might further reduced to 8.8m<sup>3</sup>/s. As a result, the probability occurrence of low flow below the baseline Q80% level of 17.8m<sup>3</sup>/s might increase from 20% within the period 1974-1988 to 33% in the period of 2030-2050. The above simulation shows that Upper Citarum River Basin urgently requires an integrated water supply system to avoid severe water shortage in the future.

**Keywords:** *Citarum, CMIP5, low flow, water shortage, water supply system*

02

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## Sustainable water resources management under climate change conditions for Ba river basin in Vietnam

Thuong Duc LE<sup>1</sup>, Huy Thanh VO<sup>1,2</sup>

<sup>1</sup> Mien Trung University of Civil Engineering (MUCE),  
24 Nguyen Du Street, Ward 7, Tuy Hoa City, Phu Yen, Vietnam

<sup>2</sup>Email: vothanh Huy@muce.edu.vn

**Abstract.** In order to contribute to the social and economic development as well as sustainable water resources development under climate change conditions in Ba river basin, it is necessary to carry out integrating climate changes in intergrated water resources management (IWRM) scientifically and systematically. Therefore, this paper carried out doing research on scientific foundation to IWRM in Ba river basin including contents: (1) Analyze to determine problems in water resources exploitation and management as well as the effects of climate changes on water resources management in Ba river basin. Estimate the ability of water resources recession. Estimate the contradictions in water resources utilization and exploration on catchment area in detail. (2) Determine methods to calculate the water balance in Ba river basin. (3) Determine the climate change scenarios as well as basic methods to assess the fluctuation of water resources under climate changes conditions. (4) Determine methods to evaluate the vulnerability of water resources. (5) Build the process of mainstreaming climate changes- 2 -into sustainable water resources management. Basing on the scientific foundation the adaptation solutions to implement IWRM in Ba river basin were addressed and detailed assessed.. Moreover, the study mainstreams climate changes into water resources management as well as determines the tools to enhance sustainable water resources management efficiency in river basin.

**Keywords:** *Ba river basin, intergrated water resources management (IWRM), climate change, sustainable water resources*

03

## A Prototype of Power Control Hardware for Raspberry Pi to Extend Operation Time in Environment Monitoring

Fujisawa Tsutomu<sup>1</sup>, Tay Wei Jie<sup>2</sup>, Tajima Koji<sup>3,4</sup> & Deguchi Toshinori<sup>5</sup>

<sup>1,3,5</sup> 2236-2 Kamimakuwa, Motosu-city, Gifu 501-0495, Japan

<sup>2</sup>9 Woodlands Avenue 9, Singapore 738964

<sup>4</sup>Email: ktajima@gifu-nct.ac.jp

**Abstract.** We introduce a trial product of the environment monitoring system by using single board computer. It can take a photo, measure the temperature and light intensity and confirm with a web page. It is effective to reduce damage from the large-scale disasters such as flood and landslide. We used the Raspberry Pi 3 as the monitoring device and measured its power consumption. As a result, it can only work 2 days with 20,000 mAh battery for mobile devices. We developed the hardware to reduce the power consumption with intermittent operation. We reevaluate this system; the monitoring device can work 87.4 days in theory. In actual usage, the operating time is 12% shorter than the calculation result.

**Keywords:** *environmental monitoring, raspberry pi, energy saving methods.*

04

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## Building Detection of Computational Fluid Dynamics Algorithm for Air Pollutant Dispersion

Ubaidullah Selamat<sup>1</sup>, Muhammad Hasbullah<sup>2</sup>, Kahar Osman<sup>3</sup> & Zahran Khudzari<sup>4</sup>

<sup>1,2,3,4</sup> Computational Fluid Mechanics Laboratory,

Faculty of Mechanical Engineering,

Universiti Teknologi Malaysia,

81310 UTM Skudai, Johor, Malaysia.

Email: <sup>1</sup> ubaidullah.selamat@gmail.com

<sup>2</sup> mhasbullah@utm.my

<sup>3</sup> kahar@fkm.utm.my

<sup>4</sup> zahran@biomedical.utm.my

**Abstract.** Air pollutants are continuously degrade human health especially in urban areas. An algorithm was developed to predict the ground-level air pollutant concentration in a complex building environment using computational fluid dynamics (CFD) approach. This paper focuses on the building detection technique used in the CFD algorithm. Building detection algorithm performs well in residential area with more than 95% detection accuracy. The algorithm performs moderately in building orientation detection.

**Keywords:** *Air Pollutant Dispersion, Computational Fluid Dynamics, Urban Building Detection.*

05

## Environmental sustainability and Low Carbon Development in Malaysia.

Chin Siong HO<sup>1</sup>, Loon Wai CHAU<sup>2</sup>, Gabriel Hoh Teck LING<sup>3</sup>

<sup>1</sup>University of Technology Malaysia  
Skudai, Johor Bahru Malaysia

Email: <sup>1</sup>ho@utm.my; <sup>2</sup>lwchau@utm.my; <sup>3</sup>gabriel.ling@utm.my

**Abstract.** – In Asia, there is a mix of developed and developing countries with different levels of socio-economic and political developments. The different levels of economic development determine focus of environmental sustainability policy and the priorities of these countries dealing with ecological challenges. Malaysia aims to become a developed nation by 2020. Malaysia is also fully committed to being a key part of the global transition to a low-carbon, and eventually **carbon-neutral** society, with ambitions of achieving this by 2050. In terms of urban development, the government policies are formulated towards creating a resilient, low-carbon, resource-efficient, and socially-inclusive cities. Climate change is considered as new dimension of sustainable development. Cities are the key focus areas for the implementation of climate change mitigation and adaptation measures. Many cities in developing countries in Asia are looking for a good and effective model to incorporate climate change policies in urban planning. Malaysia is one of the few Asian countries committed to carbon mitigation and adaptation efforts. As urban areas functioned as economic nodes and home to major populations, the government recognised the importance of low carbon, sustainable and resilient development in cities. This paper aims to discuss how Malaysian cities pursuing environmental sustainability and low carbon development for sustainable development at city levels. The findings based on 3 different empirical cases of Iskandar Malaysia, Kuala Lumpur, and Putrajaya. The empirical result showed that there is a concrete and practical steps to achieve environmental sustainability and low carbon transformation. Low carbon and resilient development initiatives can be strategically integrated with the existing development agenda to further promote urban sustainability. For effective implementation, it is important to incorporate existing policy direction, geographical setting, political cultural, socio-economic, financial capacity and human capital.

**Keywords:** *Environmental sustainability, Low Carbon Development, Urban planning and Malaysia*

06

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## Numerical Simulation of Local Wind and Air Pollution Distribution over Java Island, Indonesia

Asep Sofyan<sup>1</sup>

<sup>1</sup>Department of Environmental Engineering, Institut Teknologi Bandung,  
Jalan Ganesha No. 10 Bandung, Indonesia

<sup>1</sup>Email: asepf@ftsl.itb.ac.id

**Abstract.** To know air pollutant transport over Java Island, Indonesia, numerical simulation for simulating local wind and air pollution distribution has been conducted by using WRFChem model for selected days from January-December 2016. Based on the calculated wind field, we can roughly conclude sea breeze in north coastline of Java Island area develops on almost all days in the dry and wet season. The model result shown to produce the PM<sub>10</sub>, NO<sub>2</sub> and SO<sub>2</sub> concentration distribution following local wind behaviour. The simulations demonstrated that the sea and land breezes largely characterize the air pollution distribution over north coastline of Java Island. Moreover, high mountainous area at south coastline of Java Island has reduced developing of sea and land breeze.

**Keywords:** *air pollution, numerical simulation, WRFChem, Java Island.*

07

## Ethanol production from the conversion of palm oil mill effluent by anaerobic process: Influence of iron (II) addition for acidogenic product formation

Marisa Handajani<sup>1,2</sup>, Andri Gumilar<sup>3</sup> & Mindriany Syafila<sup>4</sup>

<sup>1,3,4</sup>Department of Environmental Engineering, Institut Teknologi Bandung, Bandung

<sup>2</sup>Email: marisa.handajani@ftsl.itb.ac.id

**Abstract.** The identification of new and renewable sources of energy has become a matter of priority in recent years. One of those renewable energy is a biofuel derived from biomass conversion, such as fuel ethanol. Ethanol can be considered to be one of the alternative energy and potentially good source of clean energy. Ethanol can be obtained by using various types of substrates, such as raw materials containing saccharides, starch, and biomass cellulose i.e agricultural waste, agri-industrial waste. The use of substrate selection based on availability of resources, economic efficiency considerations, as food materials availability, and other factors. Palm oil mill effluent (POME) is an agri-industrial wastewater with high concentration of organic contents from palm oil production. POME can be utilized as a substrate to produce ethanol through the pathway in fermentation process under anaerobic condition. Anaerobic treatment reduces organic content and generates some substances, such as volatile acids, alcohol, methane gas, etc. The aim of this study were to determine effect of iron (II) addition for ethanol production. Palm oil mill effluent with the total COD concentration of 24,500 mg/L have been used for this study. Concentration of the iron (II) which added are 0.5; 1.0; 2.5; 5.0; 10; 20 and 40 mg/L. Circulating Bed Reactor is used and operated in a anaerobic batch system for 72 hours. Addition of the iron with concentration of 2.5 mg/L can produce ethanol with the highest concentration that is 674.5 mg/L with the highest formation rate is 18.7 mg/L/hour.

**Keywords:** anaerobic processes; ethanol; metal addition; palm oil mill effluent (POME); renewable energy.

08

## Assessment of Domestic Material Consumption for Sustainable Consumption and Production in Uzbekistan

Ozoda Yuldasheva<sup>1,2</sup>, Naohiro Goto<sup>3</sup> & Guido Sassi<sup>4</sup>

<sup>1</sup>Turin Polytechnic University in Tashkent (Uzbekistan)

<sup>3</sup>Toyo University (Japan)

<sup>4</sup>Politecnico di Torino (Italy)

<sup>2</sup>Email: ozo\_ham@yahoo.com

**Abstract.** This article presents the socio-metabolic transition of the Republic of Uzbekistan through breaking down economy-wide material flow accounts by four main categories: fossil fuels, industrial minerals and ores, construction minerals and biomass and embedded ten types of material subcategories in 1992-2011. Material Flow Analysis (MFA) is the quantification and systematic assessment of the flows and stocks of materials within a system defined in space and time. MFA is used to study material, substance, or product flows across different industrial sectors or within ecosystems. International comparison analysis conducted in term of per capita of Domestic Extraction (DE), Physical Trade Balance (PTB) and Domestic Material Consumption (DMC) indicators with the same transition economies in Central Asia countries: Kazakhstan, Turkmenistan and in European countries: as transition economy of Czech Republic and industrialized country of United Kingdom (UK). The development of all of the category material flows was indispensable for the socio-economic development of Uzbekistan during its transition period. Rapid increase of GDP per capita and technological change were the main drivers of DMC during the second period in Uzbekistan. International comparison suggests that the development of DMC in all countries was driven very little by population, as this was quite stable over the period of study. Absolute decoupling is occurred in Czech Republic, Kazakhstan and UK while in Turkmenistan and Uzbekistan found relative decoupling during the period of study.

**Keywords:** Decoupling, Domestic Material Consumption; Material Flow Analysis; Sustainable Production and Consumption; Uzbekistan

09

## Applying to the Stability Problems in Geotechnical Engineering using Rigid Plastic Finite Element Analysis

Kazunori Mizuno<sup>1</sup>

<sup>1</sup> Department of Civil Engineering, National Institute of Technology, Gifu College,  
Gifu, Japan 501-0495  
Email: kazu@gifu-nct.ac.jp

**Abstract.** The purpose of this research is applying the Rigid Plastic Finite Element Method (RPFEM) to 3 types of stability problems in geotechnical engineering, comparing with existing conventional calculation. RPFEM is based on the upper boundary method in the limit theorem. Those stability problems which we take as an object of study are earth pressure problem, bearing capacity problem and slope stability problem in soils. The first two problems calculate the ultimate load at the equilibrium state, the last problem calculates the safety factor in soil structures. As a result, the computation based on RPFEM indicated calculated accuracy is almost even or improve better than existing conventional calculation. It can be said that RPFEM is applicable to geotechnical engineering.

**Keywords:** *Stability Analysis, RPFEM, Earth pressure, Bearing Capacity, Slope Stability.*

O10

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## Influence of spatial autocorrelation length of corroded thin-walled member thickness on ultimate compressive strength

Naohiko WATANABE<sup>1</sup>, Masato SUZAKI<sup>2</sup> & Masafumi TANAKA<sup>3</sup>

<sup>1</sup>National Institute of Technology, Gifu College, Japan

<sup>2</sup>JFE Engineering Corporation

<sup>3</sup> Musashino University, Japan

<sup>1</sup>Email: watanabe@gifu-nct.ac.jp

**Abstract.** We investigated the relationship between the characteristics of the thickness distribution of a corroded plate and the ultimate compressive strength through an elastic-plastic FE analysis. We used a simulation model following a Gaussian random field, each of which had a specific autocorrelation length. Parametric analyses showed that the ultimate strength of the plate had a linear declining trend with increasing autocorrelation length such that its length was less than the specific value. To investigate the effect of imperfection, we used the model and included the initial deflection obtained by eigenvalue analysis and the eccentricity resulting from the roughness of one side. Results showed that the magnitude of the effects of the initial deflection and the eccentricity on the ultimate strength depended on the autocorrelation length of the thickness distribution. We proposed a method for estimating the ultimate compressive strength using the concept of "effective region" with a specific width; this is the length for calculating the minimum average thickness, which has the strongest correlation to ultimate strength. We found that almost all local plastic deformations occurred in the region having this specific length, and this length was nearly equal to the local buckling length of the corroded member obtained experimentally

**Keywords:** *buckling, corroded plate, spatial autocorrelation, variogram*

O11

## Study on Compressive Strength Characteristic and Aging of Flow Value of Geopolymer Mortar with Fly Ash as Active Filler

Toshitsugu Inukai<sup>1,\*†</sup>, Ashidmaa Batsuuri<sup>2</sup> and Asaka Sekiya<sup>3</sup>

<sup>1</sup>Department of Architecture, National Institute of Technology, Gifu College, Japan

<sup>2</sup>Department of Architecture, Faculty of Engineering, Chiba University, Japan

<sup>3</sup>Gotemba Maintenance and Service Center, Tokyo Branch Office,

Central Nippon Expressway Company Limited, Japan

Email: <sup>1</sup>inukai@gifu-nct.ac.jp, <sup>2</sup>redthriller15@gmail.com, <sup>3</sup>a.sekiya.aa@c-nexco.co.jp

\*Presenter; † Corresponding author.

**Abstract.** In this study, compressive strength characteristics and aging of flow value of geopolymer mortar using fly ash were experimentally examined. As a result, following knowledge was obtained. (1) Compressive strength increases using finely ground fly ash and high concentration aqueous sodium metasilicate solution. (2) Aging of flow value and compressive strength tend to be different depending on Concentration of sodium metasilicate aqueous solution, presence or absence of fine grinding of fly ash, and addition rate of setting retarder. Moreover, it was hypothesized that state of floc formation is different depending on presence or absence of fine grinding of fly ash. Then, it was shown that it is necessary to verify influence on unit quantity of sodium metasilicate aqueous solution, aging of flow value, and compressive strength characteristics.

**Keywords:** fly ash, geopolymer, sodium metasilicate, anhydrous citric acid, compressive strength, flow value

O12

## Weakening of Reinforced Concrete Frame Cracked by Construction Stage subjected to Seismic Loading

Le Huu Thanh<sup>1,2</sup> & Trinh Xuan Vinh<sup>3</sup>

<sup>1</sup>Department of Civil Engineering, Central for Experimental Test Method and Verification of Construction Engineering, Hanoi Architectural University,

km-10, Nguyen Trai, Van Quan, Ha Dong Ward, Ha Noi City, Vietnam.

<sup>3</sup>Central for Experimental Test Method and Verification of Construction Engineering,  
Hanoi Architectural University, km-10, Nguyen Trai, Van Quan, Ha Dong Ward, Ha Noi City, Vietnam

<sup>2</sup>Email: thanhhuule2109@gmail.com

**Abstract.** This paper presents the investigation and quality verification results of existing reinforced concrete frame cracked by construction stages. The RC frame with three floors occurred cracks on beam during construction and become more severe after the opening from 6 – 12 months. The cracks developed from the bottom to top of the beam height. Numbers of crack happened around from 5 to 10 tracks per beam span and width of 0.1 to 0.5 mm. The cracks affect the building operation as leaking, damages and unsafe. The purpose of this study is accordingly to specify the reasons of failures and re-check capacity of frame structure subject to loading. The study results are used as decision to give strengthening method. During this research performed, the building have to continue operating, thus the procedures following as: (1) Investigate and check quality and the current statement of building; (2) To re-analyze the capacity of building frame structures; and (3) Check capacity of frame subjected to seismic loading. Based on the results of analysis, the design recommendations are proposed for the structural and construction engineers.

**Keywords:** Reinforced concrete frame, Reinforced concrete failure, Construction stages, seismic loading, frame structure strengthening,

O13

## The Influence of Masonry Infills on the Seismic Response of Reinforced Concrete Frame Structures according to Modern Conception

Phan Van Hue<sup>1,2</sup>, Nguyen Le Ninh<sup>3</sup>

<sup>1</sup>MienTrung University of Civil Engineering (MUCE),  
24 Nguyen Du Street, Ward 7, Tuy Hoa City, Phu Yen, Vietnam

<sup>3</sup>National University of Civil Engineering (NUCE),  
55 Giai phong, Ha Noi, Vietnam

<sup>2</sup>E-mail: phanvanhue@muce.edu.vn

**Abstract.** The presence of masonry infills significantly affects to the seismic response of reinforced concrete (RC) frame structures. However, in the modern seismic codes, this issue has not been specifically addressed, especially when the structures are allowed to work beyond the elastic limit. The paper introduces a nonlinear behavior model of the masonry infills that the authors have set up and it has been applied to evaluate the seismic response of RC frames designed according to modern conception when considering the interaction with the masonry infills. The results of nonlinear static analysis show that the masonry infills are likely to cause a sudden collapse of the structures, override the seismic design of the structures and undermine the efforts of the designers.

**Keywords:** masonry infills, reinforced concrete frame, nonlinear static analysis, nonlinear behavior model, interaction.

O14

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## Development of an automatic defect inspection system for civil infrastructure based on computer vision technologies

Cuong Nguyen Kim<sup>1,2,3</sup>, Son Quang Le<sup>1</sup>, Kei Kawamura<sup>3</sup>, Masatoshi YOSHIZAKI<sup>4</sup>

<sup>1</sup>MienTrung University of Civil Engineering (MUCE),  
24 Nguyen Du Street, Ward 7, Tuy Hoa City, Phu Yen, Vietnam

<sup>3</sup>Yamaguchi University,  
1677-1 Yoshida, Yamaguchi City, Yamaguchi, 753-8511, Japan

<sup>4</sup>Sumitomo Mitsui Construction Co., Ltd., Tokyo, Japan

<sup>2</sup>E-mail: nguyenkimcuong@muce.edu.vn

**Abstract.** This paper presents an automatic defect inspection system for concrete tunnel lining based on image processing technique and computer vision. The system includes a video image acquisition device, an image stitching software, and a crack detection software. Firstly, the video image acquisition device uses six video cameras and three illuminators mounted on a steel framework which is capable of sliding from side to top of the inspecting vehicle to shoot the full surface of the tunnel lining. Secondly, the image stitching software based on image matching technique was developed to create layout panorama from the tunnel lining surface images, making it easier to visualize a large and detailed section of the tunnel lining. Finally, we propose a semi-automatic crack detection software relied on combination of image processing technique and interactive genetic algorithm (iGA) to crack detection for concrete surface images of the tunnel lining. Experimental results demonstrate the effectiveness of the proposed method.

**Keywords:** crack inspection system, video image acquisition device, image stitching, crack detection, interactive genetic algorithm, computer vision

O15

## Actual condition of support to foreign residents in disaster -Case study of Fukui prefecture-

Akemi EMOTO<sup>1</sup>

<sup>1</sup>Geshi, Sabae city, Fukui prefecture, JAPAN, Zip.916-8507

<sup>1</sup>Email: emoto150@fukui-nct.ac.jp

**Abstract.** Recently, Japan is facing the issues of population decrease and a super-aging society, as well as the issue of frequent disaster. On the other hand, efforts are being made to promote disaster reduction by self-help of residents and mutual assistance in community activities. However, Yang's[1] survey showed that informed disaster information to foreign residents is inadequate. The purpose of this research is to understand the actual situation of support to foreign residents by the administration of Fukui prefecture at the time of disaster, and to consider the contents to be provided and its method as a case study of Fukui prefecture. The research method is a questionnaire survey to each city and town after conducting preliminary survey of prefectural policy. As a result, it was found that evacuation information at the time of a disaster was notified to foreign residents in the same material as general residents, and was revealed that the International Exchange Association is largely responsible for much of information transmission and information provision. It was clear that public awareness and education of risk avoidance behaviors at the time of emergency are not being done, and there is a shortage of information for residents from different areas to protect themselves. At first, given the holding of the Tokyo Olympics in 2020, it can be assumed that more foreign residents and temporary residents will visit all over Japan, so it is necessary to establish a system of local governments that can provide minimum information. Finally, we must consider the disaster prevention community activity system that can be participated by foreign residents.

**Keywords:** Disaster; Foreigner; Community design; Disaster education; Information Design.

016

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## Development of Smartphone Applications for Gifu Prefecture Disaster Prevention Information Systems

Yasuyuki Hirose<sup>1,2</sup>

<sup>1</sup>National Institute of Technology, Gifu College

<sup>2</sup>Email: hirose@gifu-nct.ac.jp

**Abstract.** In Japan, many disasters have occurred. In Gifu Prefecture, disaster information system by Web – GIS is in place. By using Web - GIS, we can quickly gather information such as when, where, and what type of disaster occurring quickly. In this research, applications for smartphone of disaster information system are developed and evaluated. There are two systems according to the purpose concerning natural disasters and biological damage of alien species. By the questionnaire survey, several points of difficulty in using the application were found and improved development. As a result, both the system and the application gained high evaluations.

**Keywords:** Disaster Prevention; GIS; Smartphone application; Natural disaster; Alien species.

017



## Methods for the assessment of the seismic vulnerability of the building stock project

Bakhrom Tulaganov<sup>1</sup>, Prof. Dr. A.A. Khodjaev<sup>3</sup>

<sup>1</sup>Obikhayot Str. 39a100239 Tashkent/Uzbekistan  
+99897 7773336

<sup>3</sup>Amir Temur St. 13100001 Tashkent

<sup>2</sup>Email: bahrombek@gmail.com

**Abstract.** Analysis of the state of load-bearing walls of public buildings under seismic influence. Effective integration into the international system for risk prediction and assessment of earthquake damage is a current task. The research objective of this work is the analysis of the technical condition of buildings and earthquake damage in Uzbekistan according to European norms and standards.

**Keywords:**

O18

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## Educational Effect of the Project Based Learning “Co+work”

Yoshihiro Kajimura<sup>1</sup>, T. Hiraishi<sup>2</sup> and Active Learning Center<sup>3</sup>

<sup>1</sup> National Institute of Technology (NIT), Akashi College/Electrical and Computer Engineering,  
Professor, Japan

<sup>2</sup>NIT, Akashi College/Architecture, Professor, Japan

<sup>3</sup>NIT, Akashi College/Active Learning Center, Japan

<sup>2</sup>Email: kajimura@akashi.ac.jp

**Abstract.** In our college, students rarely have a chance to cooperate with other students enrolled in different departments. They are all enrolled in one of four technical majors which are mechanical engineering, electrical and information engineering, civil engineering and architecture. Thus, our college started the new course, “Co+work,” as a compulsory credit to address the problem of that situation from 2016. The course includes three grades of students, 2nd, 3rd, and 4th year students, from each of the four departments. In total, 520 students were enrolled in this course in this year and were divided into 62 groups to match up with 62 faculty members. As a result, each group contained 8 or 9 students, and one teacher per group took care of his or her group as a coach. This course aimed to cultivate competency in autonomy, cooperation, and creativity through the interaction of students from the different fields as they tackled the same project. The name “Co+work” is derived from the thought of having a need to create something by cooperating in practice. And, we believe it is important to have “co-” for communication, consensus, commitment, cooperation, and collaboration. Similar exercises have been implemented in many universities and NIT colleges, but ours is unique in that the students consider and decide their topics to tackle rather than the teachers deciding and proposing what projects to do for them. In order to evaluate the educational effects of an interdepartmental and mixed-grade course for the Project Based Learning “Co+work” Project, this paper describes the outline of co+work and analysis results of PROG surveys.

**Keywords:** PBL, competency, interdepartmental, mixed-grade, autonomy, cooperation, PROG, Co+work

O19

International Seminar of “NIT, Gifu College” and Partner Universities  
– Environmental Sustainability, Disaster Prevention and Reduction,  
and Engineering Education –  
Gifu, Japan (March 18<sup>th</sup> – 19<sup>th</sup> 2018)

## Development and Application of an English Textbook Optimized for Technical College Students

KAMEYAMA, Taichi<sup>1,2</sup>, SUGAHARA, Takashi<sup>1</sup> & SATAKE, Naoki<sup>1</sup>

<sup>1</sup>NIT, Gifu College

<sup>2</sup>Email: kame@gifu-nct.ac.jp

**Abstract.** Technical college students (namely Kosen students) are generally said to have rather inferior skills in foreign language (English). However, this is not true. The students in the authors’ school have developed their English performance in terms of TOEIC score in the recent ten years and the scores do not pale against those of other students in the counterpart colleges and universities.

Nevertheless, the authors have thought that the English performance of their students still has a problem, which is the lack of knowledge with respect to English usage in the specific area such as math, science, and engineering. This is why the authors developed a unique textbook for using in their English classes. The textbook consists of the contents that are all related with basic math and science that the students have already learned before they entered this school. Using this textbook in the English classes, the students will learn how to express the notions of math and science in English and will consequently recognize the relation between English and their own engineering majors.

**Keywords:** *English education, textbook, scientific English, engineering education*

O20

## Active Learning Strategy in NIT, Gifu College

Nobuyuki Ogawa<sup>1,2</sup>, Tetsuro Tokoro<sup>3</sup> & Yoshito Itoh<sup>4</sup>

<sup>1</sup> Department of Architecture, National Institute of Technology,  
Gifu College, Motosu-city, Japan

<sup>3</sup> Department of Electrical and Computer Engineering, National Institute of Technology, Gifu College,  
Motosu-city, Japan

<sup>4</sup> President, National Institute of Technology, Gifu College, Motosu-city, Japan

<sup>2</sup>Email: ogawa@gifu-nct.ac.jp

**Abstract.** For more than fifteen years, National Institute of Technology (NIT), Gifu College has promoted the practice of education aimed at improving students’ activeness through student-centered approaches such as ICT education and e-Learning. The past educational practices led to the acquisition of the “Support Program for Contemporary Educational Needs (GP)” (2004) and the “Acceleration Program for Rebuilding of University Education (AP)” (2014) by the Ministry of Education, Culture, Sports, Science and Technology (MEXT).

We are fully committed to the continued advancement of smart education with active learning (AL). Financially supported through the AP since 2014, we have already completed the installment of wireless LAN and electronic blackboard systems in all classrooms of all five departments from the first to the fifth year, and introduced a total of 257 tablet and notebook computers available in the environment. Also, we introduced a server and software for creating educational materials. Intending to promote AL under the environment at a collegewide level, our college is holding faculty development (FD) sessions throughout the year: sessions on AL held after a faculty meeting (7 times a year), sessions for all teachers (2 times a year), and sessions on special topics (several times a year).

It is effective to use digital educational materials in the practice of AL. As educational materials used in AL class, we are preparing them based on the viewpoints of our college senior graduates who have worked long and/or are currently working in Japanese high-tech industries as leading engineers. Also, our college has established a rule, a system for student guidance and a server system where students who have learned the educational materials can gain practical engineering credit points through extra curriculum activities. In our college, AL, which is practiced by all teachers, is categorized into three levels. Respective teachers are required to describe the type of AL in their syllabus.

Moreover, our college is aiming for students to acquire the ability to describe matters related to engineering in English, while promoting the interactions between the teaching of technical English and that of the specialized subjects through active education.

**Keywords:** *ICT education, active learning, learning environment, smart education, educational materials, learning tools, the practical engineering credit point system*

## Development of environmental manipulation Device for severely handicapped children

Taichiro, Imada<sup>1,2</sup>, Usui Luke Yuya<sup>3</sup>

<sup>1</sup>Assoc. Prof., National Institute of Technology Gifu College

<sup>3</sup>Under graduate Student, Course of Interdisciplinary Technology Development

<sup>2</sup> Email: Imada@gifu-nct.ac.jp

**Abstract.** In our laboratory, students conduct practical research by being directly involved in addressing current social problems.

This presentation is a report on the on-going project “Practical research on the living environment for severely handicapped children” from an engineer education point of view.

The severely handicapped children in question are born with severe physical and mental disabilities, and in most cases, are unable to articulate speech nor take physical action. Therefore, the extent of their ability to interpret their environment remain unclear. The subject facility of this research are home to such children.

The aim of this project is to practically improve the living spaces of the subject facility, and to clarify the ideal environment for handicapped children.

Progress has been achieved regarding the development of a practical method for environmental improvement though productive discussions between the staff of the facility (M.D, Nurses, CarePerson) and our lab members (teacher, students) at each stage of the project.

The student’s creativity has been paramount throughout the research, and by developing, building and presenting their own ideas as the projects progresses, students have acknowledged a sense of responsibility in the potential to transform the environment of the subject children.

**Keywords:** *Practical study; Severely handicapped children ; Multiple Stimuli; Environmental manipulation device ; formulation of scenes;*

## Analysis of Flow Characteristic at stent strut configuration in Patent Ductus Arteriosus

Ishkrizat Taib<sup>1</sup>, Kahar Osman<sup>2</sup>, Ahmad Zahran Khudzari<sup>2</sup>, Muhammad Ikhwan Kori<sup>2</sup>  
& Takahisa Yamamoto<sup>3</sup>

<sup>1</sup>Flow Analysis Simulation and Turbulence Focus Group, Faculty of Mechanical and Manufacturing  
Engineering, Universiti Tun Hussein Onn Malaysia

<sup>2</sup>IJN-UTM Cardiovascular Engineering Centre, institute of human centered engineering, Universiti  
Teknologi Malaysia

<sup>3</sup>National Institute of Technology, Gifu College, Japan

<sup>1</sup>Email: iszat@uthm.edu.my

**Abstract.** Implantation of stent to maintain the patency Ductus Arteriosus (PDA) within 6 to 12 months is an alternative treatment before the patients undergo the aortopulmonary surgery. However, the treatment of Patent Ductus Arteriosus (PDA) has resulted in severe hemodynamic complications. The geometry of stent is reported to influence the growth of stenosis at arterial wall. Thus, this study aims to improve current stent geometry specific to PDA morphology to overcome this problem. Computational modelling via Computational Fluid Dynamics (CFD) method is used to predict the hemodynamic stent performance based on the hemodynamic parameters. Then, the numerical results verified by an experimental technique is implemented to analyse the results on current stent strut configuration. Statistical analysis is calculated to rank the hemodynamic stent performance as well as identify the best strut configuration. The most favourable strut configuration is then used to design new stent strut configuration specific for PDA. In the analysis of the new stent design, CFD results show low possibility of re-stenosis process due to thrombosis formation, inflammation, and neo-intimal hyperplasia. Furthermore, comprehensive CFD analysis by solving fluid-structure interaction (FSI) cases has produced an optimum stent strut configuration. The strength of stent strut configuration due to hemodynamic effect is analyzed through the Von Mises stress distribution. The results show that the improved design of stent strut configuration has excellent hemodynamic stent performance. Finally, the new stent design is predicted to be able to overcome hemodynamic complications and stent structural failure when applied specifically to PDA.

**Keywords:** *stent, patent ductus arteriosus, hemodynamic, stenosis, thrombosis, fluid structure interaction.*

## Implementation of Japanese-style TVET in Malaysian Universities: Where the journey begins

Nafarizal Nayan<sup>1</sup>, Nur Azam Mohd Napis<sup>2</sup>, Wahid Razzaly<sup>2</sup>,  
Abdul Manaf Hashim<sup>3</sup>, & Ali Selamat<sup>3</sup>

<sup>1</sup>Microelectronics and Nanotechnology – Shamsuddin Research Centre (MiNT-SRC), Institute of Integrated Engineering (I<sup>2</sup>E), Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Johor, Malaysia

<sup>2</sup>Vice-Chancellor Office, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Johor, Malaysia

<sup>3</sup>Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia, Jalan Sultan Yahya Petra, 54100 Kuala Lumpur, Malaysia

<sup>2</sup>Email: nafa@uthm.edu.my, nafarizal@gmail.com

**Abstract.** Since the Look-East policy was launched in 1981, every year more than 100 students have been sent to Japanese Universities and Academic Institutions for their higher education degree, majoring in engineering and technology. After graduation, most of them worked in Japanese companies in Malaysia. The trend continued until about the early of year 2000, where there is another group of Japanese-graduated students that continued their higher education degree until Master and PhD degrees. This group of students then came back to Malaysia and eventually became the universities’ lecturer. There are two attractions to study Master and PhD in Japanese universities. Firstly is on graduate-on-time, also known as GOT. Since most of the students that continued their Master and PhD in Japanese universities would be able to graduate on-time, others Malaysian universities lecturers were also attracted to continue their Master and PhD degrees in Japanese universities. Secondly is on the technical and vocational education training (TVET) style that is implemented during the Master and PhD studies. In Japan, during the research work, most of the student would be requested to develop their own experimental apparatus and operate their own analysis using start-of-the-art facilities. These Malaysian lecturers who’ve graduated from Japanese university were then implementing the same technique in educating young Malaysian researchers in Malaysian universities. The system such as Kohza-system, Japanese-TVET, and research group seminar became very popular in most of the Malaysian universities, especially the technical universities such as Universiti Tun Hussein Onn Malaysia (<http://www.uthm.edu.my/>) and Universiti Teknologi Malaysia (<http://www.utm.my/>). By implementing the Japanese-style TVET in Malaysia, the students were graduated with extra skill and knowledge of handling high-end equipment and creative thinking that meet the demand of the industries. Despite the many advantages in promoting Japanese-style TVET in Malaysia, there are also issues and challenges that will be discussed, such as insufficient facilities and lack of supporting staff.

**Keywords:** *Look-East policy; Japanese-TVET; higher education degree.*

## Solutions for attracting capital Investment on transportation Infrastructure at Vietnam

Tran Thi Quynh Nhu<sup>1,2</sup>

<sup>1</sup> Mien Trung University of Civil Engineering (MUCE), Vietnam  
24 Nguyen Du Street, Ward 7, Tuy Hoa City, Phu Yen, Vietnam

<sup>2</sup> Email: tranthiquynhnhu@muce.edu.vn

**Abstract.** System of road transportation often has a big original capital and during process of exploitation, there will need high and stable cost of maintenance, regular reparation...In Vietnam, road system is approximately 80% of all kinds of transportation. Therefore, investment of road system aims to serve benefit of social community and national economic development. That is the reason that government and other fund organizations have to support and construct a necessary policy to attract investment. Recently, development of Vietnam transportation system has not had a good model or solution to attract capital investment exception of government support. This study is to figure out useful solutions and how to attract variety of investment in present trend.

**Keywords:** transportation infrastructure, capital investment, road system, attracting investment

P1

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## Application of remote sensing to assess the flash flood characteristics of Ky Lo river basin in Phu Yen, Vietnam

Truc Thanh HO<sup>1,2</sup>, Van Thi TRAN<sup>3</sup> & Huy Thanh VO<sup>1</sup>

<sup>1</sup> Mien Trung University of Civil Engineering (MUCE),  
24 Nguyen Du Street, Ward 7, Tuy Hoa City, Phu Yen, Vietnam

<sup>3</sup> Ho Chi Minh City University of Technology (HCMUT),  
268 Ly Thuong Kiet Street, Ward 14, District 10, Ho Chi Minh City, Vietnam

<sup>2</sup> Email: hothanhtruc@muce.edu.vn

**Abstract.** Recent years, flood occurred to several provinces of Central Vietnam, while the situation in these has not yet been recovered, an another cold depression associated with torrential heavy rainfall consecutively happened to Binh Thuan, Ninh Thuan, Khanh Hoa, Phu Yen, Binh Dinh, Quang Ngai and Quang Nam prov. Ky Lo river covering through 2 districts of Phu Yen prov has high slope, narrow basin, mountainous location. Therefore, frequency of rapid flood occurs more often. This study used remote sensing and environmental database to analyse, construct a flood mapping to predict and prevent disaster and flood caused very heavy damages to human lives and properties.

**Keywords:** Rapid flood, remote sensing, Ky Lo river, flood mapping

P2

## High Performance Concrete using High Volume Fly Ash Content and Small Size Coarse Aggregate

Duc Vinh Bui<sup>1</sup>, Thi Hai Vinh Chu<sup>2,3</sup>, Thanh Hai Nguyen<sup>3</sup>

<sup>1</sup>Department of Civil Engineering, Ho Chi Minh City University of Technology (HCMUT),  
268 Ly Thuong Kiet Street, Ward 14, District 10, Ho Chi Minh City, Vietnam

<sup>3</sup>Department of Civil Engineering, Mien Trung University of Civil Engineerin (MUCE),  
24 Nguyen Du Street, Ward 7, Tuy Hoa City, Phu Yen, Vietnam

<sup>2</sup>E-mail: chuthihaivinh@muce.edu.vn

**Abstract.** High performance concrete with superior strength and special tight structural in comparison with those of conventional concrete has high efficiency in terms of strength, durability, environmentally friendly and sustainable construction. In this study, the new experimental results of high performance concrete materials using fly ash content over 40% of cement, 5mm to 8mm coarse aggregate particle size and 80MPa of compressive strength have already investigated. High performance concrete also exhibits self-flow ability and good workability, which can be applied to build the coastal structures that are influenced by the marine environment.

**Keywords:** High performance concrete, self-flow ability concrete, high volume fly ash.

P3

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## An Experimental Apparatus with LED Photo Sensors Aimed at Promoting Students' Initiative

Takuya Kohno

Department of mechanical engineering, National Institute of Technology, Gifu College  
2236-2 Kamimakuwa, Motosu-shi, Gifu 501-0495 Japan

Email: kohno@gifu-nct.ac.jp

**Abstract.** A light emitting diode (LED) can be used as a photodetector due to its photovoltaic effect. We conducted an experiment that measures the motion of rolling balls using LEDs as photo sensors. The measured velocity and acceleration data were consistent with the theoretical value of the experiment. This indicated that LEDs can be used as photo sensors. LEDs are inexpensive and robust, therefore if applicable to a student experiment apparatus, significant benefits will be obtained. We also proposed an experimental class using experimental education equipment using LED photo sensors. We conducted a questionnaire to verify how educationally effective the equipment was. From the results of this questionnaire, we obtained requests for improving equipment leading to active learning and recognized the connection of the learning fields beyond the experimental theme. We showed the possibility that the developed equipment could provide an experimental environment useful for active learning. In the poster presentation, we will introduce the details of the experimental apparatus using LED photo sensors.

**Keywords:** Active learning; Self-learning ability; Teaching material; Photovoltaic effect.

P4



## Experiencing Activities as an Engineer through Overseas Internship

Kohei Aoki<sup>1</sup>, Takuya Kohno<sup>2</sup> and Akira Shimizu<sup>3</sup>

<sup>1</sup>Advanced Course for Interdisciplinary Technology Development,  
National Institute of Technology, Gifu College, Japan

<sup>2</sup>Department of Mechanical Engineering,  
National Institute of Technology, Gifu College, Japan

<sup>3</sup>Liberal Arts, National Institute of Technology, Gifu College, Japan

<sup>2</sup>Email: kohno@gifu-nct.ac.jp

**Abstract.** “Practical Training” at the Advanced Course, National Institute of Technology, Gifu College is aiming at cultivating practical technical sense and improving English proficiency through experience as an engineer not only in domestic but also in overseas companies and universities, applying the outcomes to learning. I worked as an intern at TYK Ltd in the UK, a subsidiary of TYK Corp., for three weeks. It is a worldwide refractory manufacturer. Refractories are essential for making steel and are indispensable products for the high temperature and high heat industry. During the training, I experienced a wide range of work, including material load tests, quality control and packaging of finished products. In this report, I will introduce my experience and what I have learned about the activities of overseas engineers.

**Keywords:** Active learning; Cultivating practical technical sense; Improving English proficiency.

P5

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## Film Synthesis of Graphitic Carbon Nitride as a Photocatalytic Material

Hitoe Habuchi<sup>1</sup>, Hiroaki Aoyama<sup>1</sup> and Kazushi Yasuda<sup>1</sup>

<sup>1</sup>Department of Electrical and Computer Engineering, National Institute of Technology,  
Gifu College, Japan

Email: habuchi@gifu-nct.ac.jp

**Abstract.** Graphitic carbon nitride (g-C<sub>3</sub>N<sub>4</sub>) consists of two-dimensional sheets of carbon and nitrogen atoms. g-C<sub>3</sub>N<sub>4</sub> has been found to exhibit photocatalytic properties for organic contaminant degradation. Similar to the evolution of the field of TiO<sub>2</sub> photocatalysts, following this discovery, g-C<sub>3</sub>N<sub>4</sub> has been actively studied as a basis for the development of new photocatalysts. In this study, g-C<sub>3</sub>N<sub>4</sub> powder and films were synthesized by evaporating guanidine carbonate. To determine optical absorption coefficient of g-C<sub>3</sub>N<sub>4</sub>, the optical absorption spectra of the films were observed by optical transmittance and reflectance spectra, photothermal deflection spectroscopy and constant photocurrent method. The optical absorption band of the films appears at 3.3 eV. The optical energy gap is calculated to be 2.8 eV and is lower than TiO<sub>2</sub>. The photocurrent of g-C<sub>3</sub>N<sub>4</sub> films can be observed by irradiation with monochromatic light. These results suggest that g-C<sub>3</sub>N<sub>4</sub> can be applied to the photocatalyst with higher efficiency compared to TiO<sub>2</sub>.

**Keywords:** Graphitic Carbon nitride, semiconductor, conductivity, optical absorption.

P6

## First results of the plasma vertical displacement event (VDE) and driven halo current in a tokamak DEMO reactor

Y. Shibata<sup>1</sup>, S. Miyamoto<sup>2</sup>, A. Matsuyama<sup>3</sup>, N. Asakura<sup>3</sup>, H. Tanaka<sup>4</sup>, N. Ohno<sup>4</sup>, Y. Sakamoto<sup>3</sup>,  
V. Lukash<sup>5</sup> & R. Khayrutdinov<sup>5</sup>

<sup>1</sup>National Institute of Technology, Gifu college

<sup>2</sup>Research Organization of Information Science and Technology

<sup>3</sup>National Institute for Quantum and Radiological Science and Technology

<sup>4</sup>Nagoya University

<sup>5</sup>Kurchatov Institute

<sup>1</sup>Email: shibata.yoshihide@gifu-nct.ac.jp

**Abstract.** Disruptions pose a critical problem on its availability and lifetime of the tokamak fusion reactor. The operational with extremely low disruptivities must be developed, and, at the same time, the avoidance or the mitigation of disruptions is a key issue for the early realization of the nuclear fusion demonstration reactor (DEMO). Recently, JA-Model 2014 [1] was proposed as a Japanese DEMO design with the fusion power of 1.5 GW and the major radius of 8.5 m. The evaluation of heat and electromagnetic loads for different types of disruptions is important for clarifying specific issues in the DEMO design. Particularly, electromagnetic load on the in-vessel components such as divertor and blanket modules significantly affects the engineering design of their structures. In this study, the vertical displacement events (VDEs) with halo currents were simulated by the disruption simulation code DINA [1], which solves the evolution of a two-dimensional free-boundary equilibrium with the self-consistent coupling to external circuits (such as PF coils and surrounding conducting structures). The 2D geometry of the vacuum vessel and the conducting shells for the JA-Model 2014 was taken into account, and a reasonable agreement for the time history of a plasma motion and the current decay rate without halo currents was obtained with a 1.5D tokamak transport code ETA [3]. A fast-downward VDE occurred after slow movement towards the divertor region. The downward movement of the plasma was suddenly accelerated at a specific vertical position, and immediately reached the divertor region accompanied by the strong halo current. In some cases, the numerical convergence was not obtained during the fast downward VDEs, because the forces acting on a plasma became far from the equilibrium, and the stabilizing effect of the eddy current in the vacuum vessel was too weak. To monitor the eddy current produced in the divertor structure, we applied a box-type conducting structure model [4] and observed that the fast-downward motion was closely coupled to the eddy current flowing in the structures placed just behind the baffle plates and the dome, suggesting the strong electromagnetic loads imposed on the divertor structure. The presentation will involve the discussion of the critical plasma position for reducing the fast downward VDEs of a DEMO plasma.

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**Keywords:** Nuclear Fusion, Tokamak device, Disruption, Vertical displacement event, Disruption simulation

## UAV photogrammetry for topographic monitoring and river management system

Kiyoshi Wada<sup>1,2</sup>, Motohiro Otsubo<sup>1</sup> & Kyota Hashiguchi<sup>1</sup>

<sup>1</sup> NIT, Gifu College, 2236-2, Kami-Makuwa, Motosu, Gifu, 501-0495 Japan

<sup>2</sup> Email: wada@gifu-nct.ac.jp

**Abstract.** In this study, field works using a total station and photographic survey by UAVs (Unmanned Aerial Vehicles) were carried out at actual rivers in Gifu for river management system. To minimize an error and enhance the precision of UAV, underwater topography information was considered. As a result, multiplex photograph by Photo-Scan-Pro was composed, and three dimensions of river topography information were displayed. The possibility that UAV become the effective tool was shown by improving calibration to understand-like river information. Furthermore, the energy dissipating effect was estimated by two-dimensional numerical model for multi-drop structures. The result of analysis is considered from the angle of energy gradient, Froude number, turbulence intensity. As the decline of energy gradient and the sudden change of Froude number is indicated to hydraulic jump at drop structures, it is clarified that the drop works is useful to large energy dissipating effect.

**Keywords:** UAV, photogrammetry, digital mapping, river management system, numerical model, hydraulic jump, energy dissipation, fish passage

P8

## Biological treatment of electronic industrial wastewater by mesophilic UASB reactor

Haruhiko SUMINO<sup>1</sup>, Kampachiro URASAKI<sup>1</sup>, Kanna KAWAGUCHI<sup>1</sup>,  
Tsuyoshi DANSHITA<sup>2,3</sup>, Takashi YAMAGUCHI<sup>2</sup>, Kazuaki SYUTSUBO<sup>3</sup>

<sup>1</sup> Department of Civil Engineering, National Institute of Technology, Gifu College, 2236-2, Kamimakuwa, Motosu, Gifu, 501-0495, Japan

<sup>2</sup> Department of Energy and Environmental Science, Nagaoka University of Technology, 1603-1, Kamitomioka, Nagaoka, Niigata, 940-2188, Japan

<sup>3</sup> Center for Regional Environmental Research, National Institute for Environmental Studies, 16-2, Onogawa, Tsukuba, Ibaraki, 305-8506, Japan

<sup>1</sup> Email: sumino@gifu-nct.ac.jp

**Abstract.** Electronic industries are one of the popular industry in the world in the 21<sup>st</sup> century. From this industry process discharges chemical organic wastewater containing TMAH (Tetra-Methyl-Ammonium Hydroxide,  $(\text{CH}_3)_4\text{N}^+\text{OH}^-$ ), MEA (Mono Ethanol Amine,  $\text{C}_2\text{H}_7\text{NO}$ ) and sulfate ( $\text{SO}_4^{2-}$ ). This study investigated the treatment performance of UASB (Up-flow Anaerobic Sludge Blanket) reactor and the degradation pathway of TMAH and MEA.

Continuous feeding experiment carried out during 449 days. UASB reactor with total volume of 2.0 L and total height of 0.74 m was operated at  $35 \pm 2$  °C. The influent concentration of total COD, TMAH, MEA and sulfate were 1372 mg-COD/L, 884 mg-COD/L, 311 mg-COD/L and 153 mg-S/L, respectively. The organic loading ratio (OLR) achieved 10.8 kg-COD/m<sup>3</sup>/day, total COD removal was over 80 % during this OLR. Despite of Sulfate was almost reduced, sulfide inhibition to process performance wasn't observed. Around 60 to 70 % of removed COD was degraded by methane production, and approximately 20 % of removed COD was degraded by sulfate reduction.

Batch feeding experiments carried out with a single organic source (TMAH or MEA) with sulfate. In the experiments, TMAH or MEA of 1500 mg-COD/L and sulfate of 150 mg-S/L supplied. In the TMAH and sulfate-fed experiment, TMAH was perfectly degraded, however, sulfate wasn't reduced. In the MEA and sulfate-fed experiment, MEA was degraded and sulfate was almost reduced. The results of batch feeding experiments indicated that TMAH was degraded by just methane production, MEA was degraded by methane production and sulfate reduction.

**Keywords:** Anaerobic treatment, degradation pathway, MEA, Sulfate, TMAH

P9

## ENERGY-BASED REDUNDANCY EVALUATION FOR TRUSS BRIDGES

Yoshinori Mizuno<sup>1</sup>

<sup>1</sup> Dept. of Civil Engineering,  
National Institute of Technology, Gifu College,  
2236-2, Kamimakuwa, Motosu-city, Gifu 501-0495, Japan  
Email: mizuno-y@gifu-nct.ac.jp

**Abstract.** The redundancy analysis is used to check the performance of bridges after sudden failure of their tension members. The current redundancy analysis is mainly based on a linear static analysis where the dynamic effect due to the sudden failure of the tension members is approximately considered by the so-called impact coefficient. This implies that the current redundancy check is done by the strength check method within the frame work of the allowable stress design. Therefore, the only way for the current redundancy analysis to improve the redundancy of bridges is to increase the strength of their members. An energy-based redundancy analysis is presented to take into account the energy dissipation capacity of the truss bridges due to the plastification of remaining members after the failure of some members. By the use of the proposed method, the redundancy of structures may be improved not only by the increase of member strengths but also by the increase of the energy dissipation capacity.

**Keywords:** Redundancy; Truss Bridge; Energy

P10

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## The Possibility of Introducing Ridesharing in Regions with Low Population Density -Utility as a Means of Evacuation During Nuclear Disasters-

Mitsuaki Kawabata<sup>1,2</sup> and Mitsuki Nakai<sup>3</sup>

<sup>1,3</sup>National Institute of Technology, Gifu College, Japan  
<sup>2</sup>Email: kawabata@gifu-nct.ac.jp

**Abstract.** It is necessary to form a regional public transportation network combining a variety of means of transport for local people to have mobility in their daily lives. This paper focused on ridesharing using the private vehicles of local people to examine the possibility of its introduction as a means of daily transportation in low population density regions. When nuclear disasters (nuclear power plant accidents, etc.) occur, on the other hand, different from earthquakes and tsunamis it is necessary to evacuate areas contaminated by radiation as soon as possible. However, there will be many people particularly in low population density areas lacking a means to do so. Ridesharing has the aspect of a public service based on cooperation between local residents, and it has the potential to foster further mutual assistance during disasters. The author is of the position that promotion of ridesharing starting in normal times leads to reduced damage during a disaster. In this regard, this paper set the following theoretical hypotheses: 1) there is a linear relationship between the number of people lacking private means of transportation and acceptance of ridesharing and 2) there is a linear relationship between awareness of the danger of nuclear disaster and the acceptance of ridesharing. To validate these hypotheses, we conducted an awareness survey of people living near nuclear power facilities, which indicated support for the hypotheses.

**Keywords:** Ridesharing; Public transportation; Awareness survey; Nuclear disasters;  
Evacuation behavior; Mutual assistance

P11

## A Study on Comparison with Classical Mechanical Phenomena by Peridigm Quasi Static Analysis

Ryoichi Shibata<sup>1</sup>, Kohei Fujita<sup>2</sup>

Department of Arch, National Institute of Technology, Gifu College, Japan

Email: <sup>1</sup>ryos@gifu-nct.ac.jp

<sup>2</sup>2017y31@edu.gifu-nct.ac.jp

**Abstract.** Finite element method (FEM) such as beam elements, shell elements, and continuum elements is used as a method for structural analysis of buildings. Although it is possible to obtain large deformation such as ultimate behavior by FEM, there is a drawback that the convergence of calculation is bad. Fracture analysis using a particle model typified by a particle method can be cited as one analysis method which is good at dealing with large deformation and accompanying destruction phenomena. In this paper, we use Peridigm which handles destructive analysis based on Peridynamics which is a relatively new theory among them. However, Peridigm has not sufficiently studied static phenomena such as deformation of members due to load like FEM. For this reason, we conduct quasi-static analysis with Peridigm and compare it with the results of analysis with FEM to examine the significance of structural analysis using particle model.

However, it is not practical because it is necessary to solve the calculation of enormous steps to analyze phenomena of a long time. Therefore, by using the semi-static analysis solver provided in Peridigm, we solve the time-dependent dynamics problem like FEM.

In the elastic model, FEM and Peridynamics are equivalent in tension and compression, and Peridynamics is excessive in bending. In addition, by using the elastic-plastic model, it was possible to confirm the necking phenomenon of the steel even in the cool analysis method. From these results, it was proved that it is possible to reproduce mechanical phenomena like a continuum also in a particle model.

*Keywords:* Peridynamics, Fracture Analysis, Quasi static

National Institute of Technology,  
Gifu College

2236-2 Kamimakuwa, Motosu-city,

Gifu 501-0495, Japan

TEL: +81-58-320-1211

E-Mail: [global@gifu-nct.ac.jp](mailto:global@gifu-nct.ac.jp)