International Seminar of "NIT, Gifu College" and Partner Universities
– Environmental Sustainability, Disaster Prevention and Reduction, and Engineering Education –
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Research Activities for Water Disaster Resilience in Asia

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Abstract. Without people there is no disaster (O'Keefe et al. 1976). There is no disaster on a desert island where no people live and no property exists. When a typhoon strikes such desert island for example, there is a hazard but there is no disaster, because there are no human and socio-economic losses. A disaster is a social phenomenon (Takahasi 2012), because a disaster appears as a result of the combination of natural phenomena and social (anthropogenic) conditions (Fig. 1). Rainfall and flooding are natural phenomena that may cause damage and losses in human societies. They should be paid attention in Asia where large part of the globe population is living. To observe (estimate) rainfall over wide areas, each national hydro-meteorological service is operating weather radars individually in Asian countries. An attempt to share the information of radar-based rainfall in the region has been conducted in a research project (Fig. 2). Such information is useful to improve hydrological (rainfall and flood) prediction (Fig. 3) in river basins in the region.

To make resilient societies and to reduce disaster risks, the information of rainfall and flooding should be utilized in local communities. In many situations, there are large gaps between local needs and the information existed. For example, residents in a community want to learn the characteristics of rainfall and flooding in their region, but it is difficult because they cannot access the existing information necessary to learn. To fill the gaps, the process "bridging" (Kobayashi 2010) should be introduced. After the learning characteristics, the information becomes their own knowledge. It makes them take actions on their own initiative for appropriate preparedness and evacuation.

Keywords: *Asia; resilience; water disaster.*

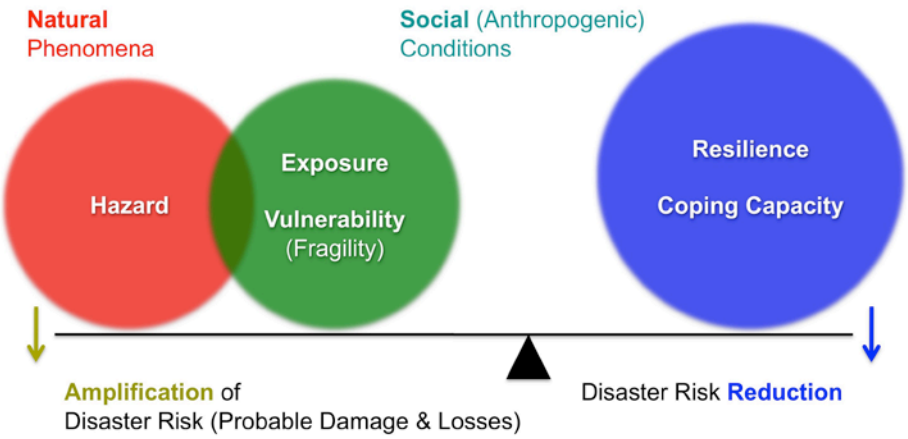

Figure 1 Schematic diagram of disaster risk management.

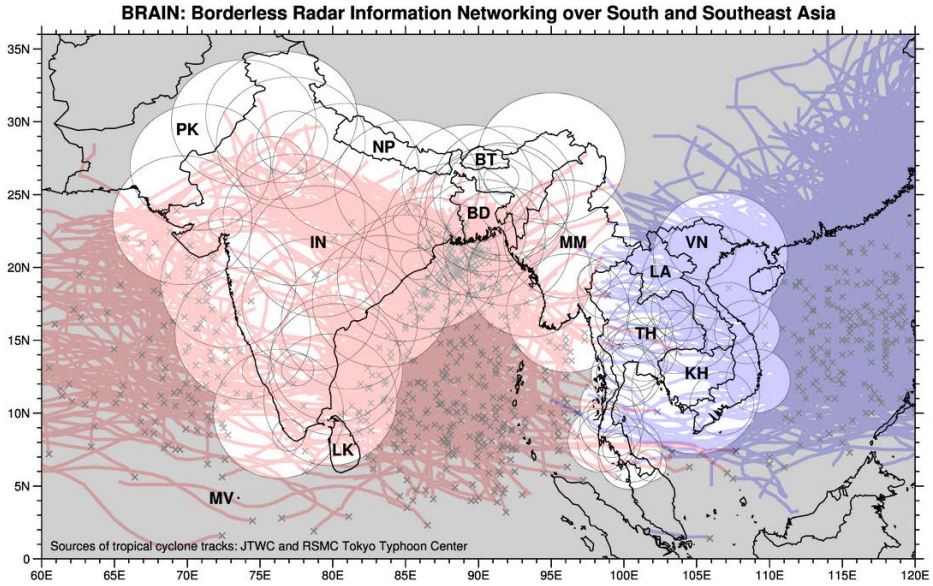

Figure 2 Borderless Radar Information Networking over South and Southeast Asia (BRAIN) project (led by H. Kamimera, http://kaken.nii.ac.jp/grant/KAKENHI-PROJECT-18K13976/).

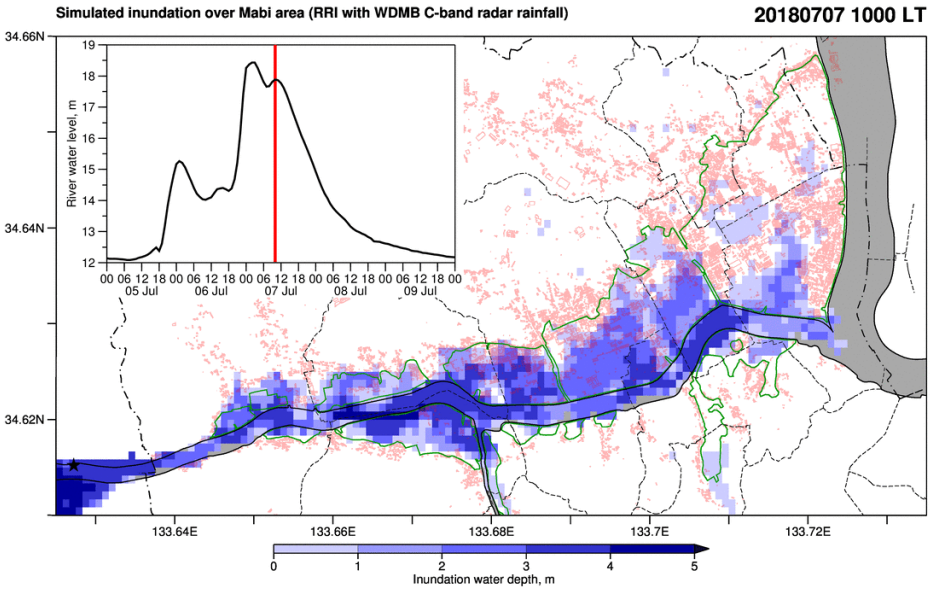

Figure 3 Buildings (red polygons) in the Mabi area of Kurashiki City in Japan, overlaid with flood inundation simulation of the Oda River (Shakti P. C. and Kamimera, will be talked in the THA 2019 conference).

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Implementation of the Kuala Lumpur Low Carbon Society Blueprint (KL LCSBP) 2030

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Abstract. Climate change has attracted collective actions and collaboration from international and national stakeholders in research innovation, policy-making and target setting. Such concerted efforts have made concrete regional and city-scale mitigation action plans and strategies towards curbing climate change and GHG emissions. However, there is still a lack of a clear and systematic methodology on how to go about policy implementation. Therefore, this paper attempts to showcase the policy implementation steps and process taken by the Kuala Lumpur City Hall (KLCH), which adopted a 10-Action, 245-Program Kuala Lumpur Low Carbon Society Blueprint 2030 in November 2017 to mitigate the city's GHG emissions. The paper helps address several vital questions related to effective, pragmatic policy implementation: (i) which programs under a specific action are deemed significant and to be prioritized in cutting the city's carbon emissions; (ii) what is the suitable implementation timeline and the target year of implementation; and (iii) who are the potential actors and agencies that are instrumental to the program implementation? To obtain stakeholders' views and feedback in response to the above enquiries, two sessions of Focus Group Discussion (FGD) have been conducted with 120 participants from various agencies including KLCH internal departments, government technical agencies, private entities and non-government organizations. Apart from the weighted scoring method which was used for evaluating the significance level of programs for implementation, most of the data were descriptively analyzed. Results show that out of the total of 245 programs, 163 LCS programs (over 66%) scored high in importance for implementation and only 9 LCS programs were considered as low in importance. As for the implementation timeline, 154 LCS programs (63%) were identified to be implemented immediately and considered as long-term programs which entail that they should be implemented continuously. KLCH's City Planning Department has been found to be responsible for spearheading, initiating and coordinating the implementation of the highest number of LCS programs by engaging with key partners and implementers. Green Urban Governance which crosscuts all LCS sectors has been found to involve the most (i.e. 10 different) KLCH departments. This paper offers a clear methodological guide and a step forward in LCS policy implementation (i.e., policy roadmap) which can be used as an example by other cities.

Keywords: *Policy Implementation, Methodology, Implementation Strategies and Approaches, Programs, Low Carbon Society (LCS), Blueprint, Kuala Lumpur, Kuala Lumpur Low Carbon Society Blueprint 2030, Malaysia*

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Earthquake Prediction and Risk Reduction in Uzbekistan

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Abstract. Uzbekistan is located in the middle of Central Asia within a zone of high seismic activity, particularly in the Northeast Tashkent Region and the Bukhara region in the southwest of the country. Earthquakes are the prevailing hazard in Uzbekistan. One of the main reasons for damages and losses from earthquake are due to improper construction method, lack of control during construction process, and the lack of effective earthquake safety among the public. The main purpose of risk reduction methodological and operational approaches to protect lives and properties against natural disaster. It is impossible to create a free risk environment, but it is very important to reduce this risk through appropriate prediction and management strategies. This paper addresses combination of predicting earthquakes and improving methods of disaster risk reduction in Uzbekistan. Although it is debatable whether this phenomenon can be predicted, we use a mathematical model based on Spatial Connection Theory, Poisson's distribution and triangulation method to increase the probability of future earthquake predictions in Uzbekistan. In addition, the second objective is to propose methodological and operational approaches to assess urban vulnerability, socio-economic losses and to improve risk reduction program in this region. This study will help decision makers to take preventive measures, develop appropriate mitigation strategies, allocate and position their resources in the right location to assist people, prevent huge financial losses and save lives.

Keywords: *Earthquake, Mathematical Model, Mitigation, Poisson's Distribution, Prediction, Spatial Connection, Seismic Risk*

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RF and Microwave Sensing Methods and Instruments for Nondestructive Testing and Evaluation

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Abstract. The physical and mechanical properties of urban structures can be inspected and monitored using nondestructive testing and evaluation (NDT&E) techniques. In particular, microwave methods have recently attracted the research community as a viable method to address NDT&E applications in a wide range of applications. In its essence, the measuring instrument is build up with a microwave detection system connected to a sensor, i.e. antenna or probe. The measured reflected or transmitted wave through the material under investigation is a function of moisture content, density, type and properties of constituents, presence and type of contaminants, presence of fatigue cracks. In contrast with conventional NDT&E techniques, RF and microwave tools operate at relatively low power in a non-contact manner. Lateral and depth resolutions can be improved by appropriate design of the sensor.

Although RF and microwave methods have gained the interest from the microwave community, they still suffer from issues to facilitate their penetration for applications outside a laboratory environment. Indeed, the inadequate commercial availability of measuring systems for NDT&E purposes is limiting the applications. Within this context, the objective of this work it to develop microwave sensing systems with features compatible with an industrial context. As the scientific investigation and the hardware development are thought as a whole in this work, the solutions developed achieve low-cost, robustness, compactness, low-power and friendly operation.

Microwave and millimeter-wave reflectometers and analyzers for the measurement of the reflection or/and the transmission properties of a material under test are described. The system architecture is based on the six-port technology that surpass conventional systems in terms of power added efficiency (PAE). The systems developed are associated to sensing elements to provide low-cost NDT&E solutions. As a demonstration, monitoring of the moisture content in building materials is exemplary demonstrated. The method is based on the measurement at 2,45 GHz of the free-space reflection coefficient of a cellular concrete material. In addition, coaxial and sub-wavelength probes will be discussed for spatial resolution enhancement down to the nanoscale.

Keywords: *Nondestructive testing and control, microwave, vector network analyzer, antenna.*

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Study on Bed Variation Management by groin at a River Confluence Combined with the Meander

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The Kakogawa River which has a catchment area of 1,730km^2 and a length of 96.0km, flows through Hyogo Prefecture in Japan. The influence of runoff due to barrage water and the Mino River tributary, combined with a meander in the river upstream from the large barrage on the Kakogawa River (Kakogawa Barrage), has promoted the development of a sand bar on the river bank opposite the confluence. The sand bar, which has enlarged and become fixed, currently deflects the passage of water back to the left bank and has decreased the usable water surface area of the river. To wash away the sandbar, the groin was installed in 2015. The purpose of this study was to survey the river topography in the vicinity of the Mino River confluence and identify the factors responsible for sand bar development by using model experiments and numerical analysis. In addition, the function of the groin and survey of the effects caused by changing the characteristics of the groin were verified. The hydraulic experiments were carried out in an 8m long, 0.8m width, and 0.4m depth rectangular main channel under the movable bed condition, in which a 0.48m width tributary channel joined in a right angle at 4.33m downstream from the upstream of main channel. Movable-bed modeling of the channels at the tributary junction was performed to assess the influence of the barrage water and the river meander upstream on river flow, and to observe the flow and the change of elevation characteristics at the junction and their influence on river topography. The numerical calculations were analyzed using the two-dimensional flow analysis software, Nays 2DH (iRIC, 2014), and three-dimensional flow analysis software, Nays Cube (iRIC, 2011), to verify the experimental results and to investigate how they can be applied.

Keywords: **river geomorphology, bed deformation, tributary, hydraulic experiment, numerical simulation**

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A Stream and River Monitoring System with a Capability to Change Monitor Interval via the Internet

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Abstract. This study was made to develop Stream and River Monitoring System with Raspberry Pi. A device which monitor the target can not only measure water levels but also take a photo or video. And the device is powered by portable battery, it can work intermittently over several months without changing battery. Therefore, the device can be deployed in place which doesn't have stable source of energy. However, the device had a problem that a monitor interval of intermittent operation is constant, user cannot specify the next monitoring time. To solve this problem, we improved system and device. As a result, the monitor interval can be changed dynamically. The device can monitor the target at specified time by getting next monitoring time from the Internet. In addition, the device moves from Raspberry Pi 3B to Raspberry Pi Zero W. We are conducting the experiments on the school grounds.

Keywords: *environment monitoring system, disaster prevention, embedded device.*

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Disaster prevention education program in cooperation with prefectural area

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Abstract.

Many disasters have occurred in Japan. It is necessary for public and private sectors to cooperate on how to prepare for disaster preparedness. And disaster prevention education has been inplemented in various places.

Students and teachers prepare their own disaster prevention education tools. And they conduct delivery classes for the local residents. In conjunction with conducting regional education activities, the disaster information system was released and user questionnaires were carried out to verify that residents can easily register information on site. Many disaster prevention goods and educational contents are created by this activity. One of the proposals won the patent contest and got a patent.

Keywords: *Disaster prevention, GIS, Regional education, Delivery class, Patent.*

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Mathematical Modeling and Dynamical Simulation of an Anaerobic Digestion in a Biogas Process

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Abstract. The biogas technology is one type of energy and sustainable development which is important to the energy and environmental planning of the world. The study and analysis of the mathematical model of the biogas process explained the variables that affect biogas process and proposed a design for biogas reactor. The model by anaerobic digestion process could also reduce the amount of waste and produce biogas, which were the high ratio of methane can be used as renewable energy. Intended research presents a mathematical modeling and parameter identification of an artificial intelligence to estimate the mathematical model of an anaerobic digestion in the biogas process which is a batch reaction. The principles of mass balance equations defined by the mathematical models. The mathematical model, dynamical simulation and the model calibration proposed by using the data obtained from experiments and real life. The model applied to simulate full-scale application, and also calibrated by using the data of full-scale plant considering the nature and quantity of the substrate to be treated and the specific reactor configuration.

Keywords: *anaerobic digestion, organic waste, biomass, periodic mixing, methanogenesis.*

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Integration of automated building generation algorithm with CFD-based air pollutant simulation solver

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Abstract. Air pollutant has been a major threat to human health and wellness especially in residential areas near urban industrial park. Simulation of industrial release across complex urban structures nearby is needed to avoid contaminated ambient air that exceeds recommended guidelines. In urban areas, multiple buildings and man-made structures exist thus affecting wind movements and pollutant dispersion across the area. In present study, a method to simplify building generation in CFD meshing procedure is proposed by detecting building footprints and footprint extrusion based on shadow length. First, building shadows are filtered using color filtering technique. Then, the shadow length is estimated by counting image pixels and relating it to the pixels of the reference building height. Results of shadow estimation show that present algorithm performs reasonably well compared to the literature. This paper presents the integration of satellite image building meshing algorithm with our in-house CFD solver based on fractional step method and mixing length model. The building generation algorithm is modified to facilitate present matrix-based CFD solver in MATLAB array format. Results of present CFD solver show that present wind solver agrees with the benchmark data. The integration provides an efficient tool that simplifies mesh generation process from satellite image in complex built environment for CFD solver especially in urban industrial park.

Keywords: Building Detection, Shadow Height Estimation, CFD Air Pollutant solver.

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Methanogenic treatment of diethylene glycol mono butyl ether containing wastewater

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Abstract. The age of the Fourth Industrial Revolution (Industry 4.0) has begun and the whole world is going to be connected by internet technology. The spread of internet technology caused a rapid increase in the production volume of technology. Methanogenic wastewater treatment has some advantages which are no aeration energy and low excess sludge. In this study, the electronic industry wastewater containing diethylene glycol mono butyl ether (DEGMBE; $C_8H_{18}O_3$) were targeted.

The organic wastewater containing DEGMBE was continuously treated in a lab-scale mesophilic up-flow anaerobic sludge blanket (UASB) reactor for 330 days in order to evaluate potential of methanogenic treatment. The OLR (organic loading rate) and temperature was set at around 6 kg-COD/m^3/day and 35 ^oC through the experiment.

The operating period of the reactor was divided into 2 phases, which aimed to evaluate the appropriate concentration of the influent wastewater and were set at the same OLR. In phase 1, influent COD and HRT were set at 1500 mg-COD/L and 6 hr. Total COD removal achieved over 95 % except the start-up period, and methane recovery was around 80 %.VFA such as propionate was not detected. In phase 2, influent COD and HRT were set at 3000 mg/L and 12 hr. Total COD removal was stable immediately from changing the operating condition, and was over 95 %. VFA such as propionate was not detected. Stable performance was observed at both phases.

The methanogenic activity experiment using the retained sludge was also carried out in order to estimate the methanogenic consortium. The test substrates were DEGMBE with several initial-concentration (1500, 3000 and 6000 mg-COD/L), acetate (1500 mg-COD/L) and H_2/CO_2. Specific methanogenic activity (g-COD/g-VSS/day) were generally increased with the reactor operational time, which appeared that DEGMBE did not inhibit the methanogenic consortium.

Keywords: *Diethylene glycol mono butyl ether, methanogenic treatment, UASB reactor*

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Conservation Historic Rural Landscape and Traditional Village in Vietnam

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Abstract. In Vietnam, conservation historic urban landscape and, architectural urban heritage has been taken up by experts and the public, in the process of urban construction planning. However, these issues have not received sufficient attention in rural areas. Traditional and cultural heritage in rural areas in general and traditional villages are facing common threats and challenges, namely by; the pressure of population growth and urbanization, time…. Preservation of space, architecture and landscapes is not only necessary in areas where historical sites are delineated but which are necessary in the most common planning of established rural settlements. This ensures that the settlements have inheritance or continuity - an aspect of sustainable development.

Urbanization and globalization - on the one hand providing economic, social and cultural opportunities. can improve the quality of life of people, but on the other hand, rapid changes without management can undermine the identity of the community. The values of cultural rural landscape include tangible and intangible components that form an important resource in maintaining and improving the viability and productivity of villages. Preserving the cultural heritage will be an effective tool for managing resources, ensuring a balance between economic development and tourism and the quality of life of people, contributing to reducing the pressure on the cities.

Keywords: *rural lanscape, traditional village, historic architecture*

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Traffic Noises and Sound Barrier Wall Solutions for Highway in Vietnam

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Abstract. This paper presents the applying of noise barrier wall for highway in Vietnam studied from the existing experiments in the world. Nowadays, the pollution sources come from the traffic noises, water sources and air environment. Especially, the traffic noises such as transportations, trains and airplanes are much serious and effect population and country. On the road traffic systems, the noise generated by vehicles is always in the high level and give discomfort to residents who live around the both side of highway. On the world, the noise barrier walls have been built along the highway to minimize the impact of traffic noise on the surrounding environment. However, such field has not been properly considered in Vietnam. Another side, this paper deals with the sound transmission mechanism in the road as well as the experience of countries in building the noise barrier system along the highway, contributing to ensure the best urban comfort for the surrounding environment and create a friendly traffic landscape.

Keywords: Noise source; sound transmission; noise barrier wall; noise pollution; highway; urban comfort; traffic landscape.

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Training program for engineers: application of artificial intelligence (AI) to transportation infrastructure system

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Abstract. The four industry revolution has affected to the economic development in Vietnam. Specially, the application of AI to the maintenance inspection of the large-size concrete infrastructures such as tunnels, damps, bridges, and pavement. Therefore, MienTrung university of civil engineering (MUCE) desires to open a new field "application of artificial intelligence (AI) to the transportation infrastructure system". The purpose of this training program is to provide a high quality human-resource for society, and for applied AI projects. The major subjects include pavement, bridge, tunnel design and construction, machine learning, automated object detection, evolution algorithm in the transport network.

Keywords: *training program, transport network, MUCE*

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Practice of Creating Prototype Products as a PBL type Active Learning

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Abstract. In this paper, we will describe our PBL challenge practiced in the "Creative Camp Project". We will explain the practice of participating students in the "Creative Camp Project" under the support of venture company, Softopia Japan and NIT, Gifu College.

The Creative Camp is a project which started in 2013 with the purpose of fostering future high-level ICT human resources. The Gifu Prefectural Government and Softopia Japan Foundation are implementing project-based learning (PBL) type activities called a "Creative Camp Project" through collaboration between companies and high school students. This is a kind of hackathon activity of PBL practice where high school students in Gifu Prefecture experience creation processes of new products and services in information and its related fields which are not taught at school. They start to use facilities of Softopia Japan, collaborate with a venture company and create a product in line with the theme.

The Creative Camp Project starts with a two-day work when they generate ideas and make a rough prototype, and after that, they create their final prototype product for about two months. Each school team works collaboratively with a venture company. During the two-day work, they raise issues on their product, work out what the real issues are, generate ideas, design and make a rough prototype, and at a mid-term presentation held on the afternoon of the second day are given feedback from an advisor for improving their product. After the two-day work they continue to work on their product after classes at their school until the final presentation day.

Keywords: *Project-based learning, Active learning, Smart education, ICT, IoT, hackathon*

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Applying KOSEN Education Model in Vietnam Engineering Colleges and Universities

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Abstract. The paper presents analysis and conclusions for applying KOSEN education model in Vietnam. KOSEN education model was founded in Japan since 1961 with much successfully and contribute for Japan education, economic and society powerful. In recent years, such model has applied for some engineering colleges and universities in Vietnam. However, author suspect that KOSEN model have not still earned the results as its expectation. This suspicion can describe with following items as: The students who enroll the KOSEN's program are not high grade and level in high school; the education's quality of the college and university applied KOSEN is very low compared with others in Vietnam; and Vietnamese society has not still understood about KOSEN clearly and deeply. Thus, the purpose of this research is accordingly to analyze and show limitations and inappropriate methodologies of applying of KOSEN in Vietnam. The study is performed with following procedures: (1) to compare the relationship between the education level of Japan and Vietnam; (2) to present Vietnam legal for the education of college, undergraduate and graduate; and (3) to analyze the inappropriate methodology that KOSEN was selected to exchange in Vietnam. Based on the results of the study, the recommendations and conclusions are proposed for applying KOSEN in Vietnam with new following methodology.

Keywords: *KOSEN in Vietnam; Vietnam education legal; education; education system; education model*

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Implementation of Look East Policy 2.0 in Malaysian Engineering Education: Way Forward

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Abstract. After the 14th general election in May 9, 2018, the Malaysian political landscape changed 180 degree due to the lost of ruling party, which had run over the country since Malaya's independence in 1957. The newly Malaysia Government is headed by Tun Dr Mahathir Mohamad who is the founder supporter of Look-East Policy 1.0 (LEP 1.0), which was launched in 1982. Through LEP 1.0 every year more than 100 Malaysian 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 and as a result, Malaysia successfully achieved and advanced economy status with various multinational companies and factories in Malaysia such as Sharp, Fujitsu, Intel, Motorola, etc.. Under the new government, Tun Dr Mahathir Mohamad is proposing the new Look East Policy 2.0 (LEP 2.0) as Japan is the first country that he visited after being sworn-in again as the Prime Minister of Malaysia. Under LEP 2.0, Malaysia should clarify the Asian economic models which we aspire to learn from. During LEP 1.0, it had been designed to learn the work ethics, technologies expertise and public-partnership policy of Japan. Engineering education at higher institution has to be focused in order to bring forward the next level of economy which not only relies on the low cost labors and manufacturing. In order to reduce the cost of Japanese's engineering education for foreigners especially Malaysian, it has been proposed to setup Japanese's branch university in Malaysia. Three Japanese Institutions have agreed to the proposal and will be operating as soon as next year. During the seminar, we will be discussion the way forward of the new LEP 2.0. Malaysia has to transform from the manufacturing country to the value added manufacturing country that may follow with the current revolution of industrial, which is known as industrial revolution 4.0. Under the smart partnership with Japanese universities, higher education between two countries needs to be discussed in detail.

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

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A Development Competition of Thinking Algorithm for Worker Placement Board Game

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Abstract. In this paper, we describe a competition of thinking algorithm for the original board game developed by our department. In our department, we have been carrying out the development of thinking algorithms of board games as a class to compete against laboratories. This class is all participatory and requires not only programming skills but also teamwork and idea. In addition, we accepted a lot of short-term international students who can only speak English in the laboratory, and at this time we have used pre-built board games as a communication tool between students. In this research, we will combine these two and interact while competingly developing algorithms for our school and overseas students to solve them, using a newly developed educational board game. By doing this, we aim to foster engineers in the field of information engineering that has a practical level of English ability, can be active internationally. Additionally, we present the contest next year scheduled, and we are looking for cooperative schools which can participate.

Maximum length **400 words**.

Keywords: *board games, algorithm, programing contest, AI.*

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Analysis of Hemodynamic Effect on Fusiform Aneurysm for Fever Patient

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Abstract. Aneurysm in the middle of cerebral artery (MCA) is the phenomenon of arterial wall bulging which is accelerates the predicament problem especially on fever patients. The MCA aneurysm contributes approximately 20 percent of the circle of Willis anterior sector which influenced of arterial wall failure due to hemodynamic differences. Fever raise the temperature, speeds up the heart rate and raise the blood pressure levels in aneurysmal sac which might be ruptured if not treated. Many studies are conducted on the arterial wall ruptured due to hemodynamic differences, otherwise, no specific study is focused on temperature differences at the aneurysmal wall. Thus, this study aims to analyse the body temperature effect on the blood flow at the aneurysmal wall especially for fever patient. Two different models of the fusiform aneurysm which are symmetrical and non-symmetrical geometries are modelled. Computational fluid dynamics (CFD) has been imposed in this study to analyse the effect of hemodynamic variables toward the different temperature distributions by analysing the wall shear stress (WSS) and oscillatory shear index (OSI) at the fusiform aneurysmal wall. From the result, the distribution of WSS and OSI is decreased approximately 0.003 percent and 0.014 percent, respectively. However, the percentage of WSS in fever patient increase approximately about 51 percent whilst the percentage of OSI effect on aneurysmal wall is decreased about 3.8 percent for hypertension condition. The high value of WSS as well as low value of OSI has a tendency and possibility of the aneurysmal wall failure.

Keywords: *Aneurysm, fusiform, hemodynamic, fever, temperature*

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A Study on Hemodynamics Changes Caused by Patent Ductus Arteriosus

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Abstract. The child patients who has hypoplastic left heart syndrome undergoes major operations such as the Norwood procedure, the Fontan procedure and the Bidirectional Glenn procedure. Patent Ductus Arteriosus (PDA) stenting, which is instead of these procedures, is recently performed to prevent closure of ductus arteriosus and to alleviate the burden for the patient. However, some clinical reports have reported that PDA stenting causes thrombosis around ductus arteriosus. The detail mechanism thrombosis formation has been still controversial. It is necessary to understand blood flow balance of aorta-pulmonary artery system in order to develop PDA stent which possibly control the thrombosis formation around ductus arteriosus. This study performed unsteady and three-dimensional CFD analysis for an aorta-arteriosus-pulmonary system based on patient-specific image data. Especially, this study focused velocity field at the central cross section in the arterial canal as a main parameter of blood flow in this region. As a Result of velocity vector and velocity distribution, it was revealed that low speed region was formed near the PDA wall surface, in addition circulating flows were observed inside the arterial canal. Some prior researches reported that the formation of thrombus occurs in region with eddies. According the reports and results of CFD analysis, this study found regions likely to generate restenosis caused by PDA stent implantation.

Key words: *particle image velocimetry, computational fluid dynamics, patent ductus arteriosus*

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Computational Fluid Dynamics Analysis for Intranasal Aerosol Deposition Using Patient-Specific Data

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Abstract. Aerosol medicine exhalation through the nose treatment (ETN) has conducted as an effective treatment for Eosinophilic Chronic Rhinosinusitis (ECRS). In ETN, the patient inhales aerosol of inhaled corticosteroid (ICS) medicine from mouth using portable inhaler. Then a part of the aerosol still floats and remains in upper airway. When the patient exhales inhaled air through the nose, the aerosol is effectively transported on the walls of middle meatus and olfactory fissure. The mechanism of how ETN improves ECRS with asthma is still controversial even though ETN gets a lot of attention as a treatment method for ECRS with asthma. In this study, computational fluid dynamics (CFD) analysis of aerosol transport phenomena were performed based on patient CT data in order to evaluate the therapeutic effect of ETN numerically. Three cases were selected in this study, one is a patient who had ECRS with asthma and a history of endoscopic sinus surgery and the others are healthy cases. 3D anatomically accurate patient-specific models were reconstructed from the data obtained using multidetector CT scanner with medical imaging software package. The entire series was loaded into the software, and then the nasal-pharynx airway was identified in each of the axial images based on predefined threshold of -300 Housfield units relative to the surrounding tissue. The nasal-pharynx airway models were exported into a CFD meshing software package to generate discrete volume cells. This study used both a Euler-Lagrange particle transport model for aerosol transport and a model for complex intranasal turbulent flow. This study analyzed both inhaled state and exhaled state, and compared the aerosol deposition characteristics under conditions by changing the particle diameter and flow rate of aerosol. As a result of CFD analysis, amount of aerosol deposition depended on particle diameter and flow rate, and tendency of aerosol deposition was consistent in all cases analyzed in this study. Furthermore, in the inhaled state, aerosol mainly deposited in nasal meatus areas where not contribute to treatment of ECRS. Exhaled state was more effective treatment for ECRS compared to the inhaled state. The results show advantages of ETN as well as CFD analysis will contribute further development of ENT.

Keywords: *eosinophilic chronic rhinosinusitis, computational fluid dynamics, exhalation through the nose treatment.*

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Study on Computational Fluid Dynamics Based on Deep Learning

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Abstract

Thermo-Fluid Laboratory, NIT Gifu College has pursued to solve medical problems using computational fluid dynamics simulation. In recent years, the development of the GPU utilization for numerical analysis and the deep learning techniques has achieved a remarkable breakthrough. The authors have tried to combine such the techniques to solve heat and mass transfer problems inside human body. The combination of the GPU utilization and the deep learning has great possibility to advance conventional computational fluid dynamics simulation and remarkably reduce calculation time. However computational fluid dynamics simulation based on deep learning still remains to be established.

This study presents a method of computational fluid dynamics simulation using deep learning technique. 1550 airfoil data are used in this study to construct neural networks, and generative adversarial network and U-Net architecture is used as neural network. This study has conducted flow simulation around the airfoils using Reynolds-Averaged Navier-Stokes solutions for optimization of the neural network. In order to evaluate the accuracy of the computational fluid dynamics based on deep learning, results of pressure and velocity distributions are compared with that of conventional computational fluid dynamics simulation. As results of the comparison, deep learning model developed in this study shows good agreement and its calculation error is less than 3%.

Although the neural network architecture is constructed using airfoil data, it's easy to apply to a wide range of problems because the architecture has high versatile and applicable. In the future step of this study, the authors are going to apply this simulation method to mass and heat transfer inside nasal-pharynx cavity flow.

Maximum length **400 words**.

Keywords: *Computational Fluid Dynamics, Deep Learning, Generative Adversarial Network, Reynolds Average Navier Stokes Turbulence Model*

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Method of determining the total cost in each year of operation of municipal solid waste management projects in Vietnam

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Abstract. With strong urbanization in the past decade, Vietnam has faced great challenges in urban management and municipal solid waste management is one of them. In the past, most of municipal solid waste was be buried, but in recent years the landfills have been limited and replaced. The projects are invested with large scale, modern disposal technology. The investment process of projects must assess the project efficiency in terms of financial and social aspects. In particular, the benefits and costs of the project should be clearly analyzed. In terms of cost, the total cost allocated to a tonne of municipal solid waste treated during the operation phase must be determined accurately and appropriately. Therefore, it is necessary to develop a method for determining the total investment cost of municipal solid waste management projects in the operation phase. This study has two main purposes. The first is to establish a complete methodology to determine the total cost of project in operation phase based on theory of V.Liogkas. The second is to apply the above method to calculate the typical municipal solid waste management project in Vietnam.

Keywords: *municipal solid waste, municipal solid waste management, total cost, Vietnam*

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The Path to Industry 4.0. Creation of Digital Learning Factory for training students of technical universities

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Abstract. Nowadays, manufacturing is moving to the next phase of digitalization through the Industry 4.0 concept. This new paradigm supported by innovative technologies such as Internet of Things, Cloud Computing, Augmented reality, System Simulation, System Integration etc. Industry 4.0 is a vision commonly used to describe the concept of "Smart Factory" of the future. In smart factories the manufacturing processes will be fully automated and cyber physical systems will be able to communicate with one another and cooperate networks to achieve a common goal. With these new technologies, innovative didactic concepts are required to cope with new arising tasks on the job and in the development of such systems. Besides, the requirements of engineering work has been shifting from largely manual labor to programming and data analysis skills. Engineers with low skill levels risk becoming replaceable unless they are retrained. On the other hand, workers able to make the transition to Industry 4.0 may find greater autonomy and more interesting or less arduous work. Employers need personnel with creativity and decision-making skills as well as technical and Information Communication Technologies expertise. Thus, this article describes the transformation process of a training-addressed manufacturing process, in order to structure a Digital Learning Factory for the mechanical engineering program at Tashkent Turin Polytechnic University (TTPU). To enable development of competence on cyber-physical production processes and systems a design approach for implementation in learning environments is presented. First, the requirements of Smart Factory for engineering workers was analyzed then implementing of CPS in Learning Factories and education systems is presented. Later, framework for Digital Learning Factory (DLF) was proposed and finally a case study illustrates the proposed implementation framework in a real learning factory. This developed DLF framework will help to teach engineering students not only in TTPU but also for other regional technical universities students. Besides this, proposed DLF framework can be used for the practical qualification of the engineering employees.

Keywords: *Industry 4.0, Learning Factory, CPS, Didactic*