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CRASHWORTHINESS ANALYSIS OF MULTI-CELL SQUARE TUBE UNDER IMPACT LOADING

THANH DANG VAN[1], SON DOAN THANH[2], TRUC DO TRUNG[3], HOANG DO KIM[2], TU PHAM HOANG[2], NHAN TRAN TRONG[4]*

[1]*Ca Mau Department of Transportation, Ca Mau, Vietnam*

[2]*School of Engineering and Technology, Van Lang University, Ho Chi Minh City, Vietnam*

[3]*Nguyen Truong To Technical College, Ho Chi Minh City, Vietnam*

[4]*Industrial University of Ho Chi Minh City, Vietnam*

**trantrongnhan@iuh.edu.vn*

Abstract. The crashworthiness of multi-cell square tubes under axial impact loading is investigated using numerical simulation. To point out the best structure applicable to the design of the energy absorber, a decision making method (DMM) is used. The objects employed for the DMM are specific energy absorption (SEA) and peak load (PL) and tube mass. The discussion about crashworthiness characteristics is presented, for which, the tube parameters have a great effect on tube crashworthiness. Since the width and thickness exceed the critical values of 60 mm and 1.8 mm, reducing the tube's SEA due to the same impact time.

Keywords. decision making, Impact, Tube.

ICATSD2A.402

DATA INFORMATION IN THE LINKAGE OF CONSTRUCTION SUPPLY CHAIN: A CASE OF VIETNAM

TRAN PHU LOC
University of Transport Ho Chi Minh City
loc.tran@ut.edu.vn

Abstract. Supply chain development can be seen as an innovative trend in the construction industry; in addition, digitization and data information management based on the advancement of technology will be motivated to link in the chain. However, data information in the construction is very varied, constantly changing over time, while the information needs of the parties in the construction supply chain are always different. Besides that, in large-scale construction projects in Vietnam and other countries around the world, the implementation time is long, and the information data flow is formed in the project phases with the participation of many members such as consults, clients, main contractors, subcontractors, and suppliers. Moreover, the construction supply chain's categorization of demand, supply, control, exploit, and the reliability of the data information is limited. Based on the collected data, the author uses a qualitative and quantitative method to clarify the issues of data information management in the construction supply chain in Vietnam, thereby proposing an effective way to exchange data information to strengthen the supply chain linkages.

Keywords. data information; Construction supply chain; linkage of the supply chain.

ICATSD2A.403

NUMERICAL INVESTIGATION ON CONJUGATE HEAT TRANSFER OF LIQUID COOLING PLATE FOR HIGH HEAT DISSIPATION ELECTRONIC DEVICES USING OPENFOAM®, AN OPEN SOURCE CFD SOFTWARE

XUAN-HUNG NGUYEN[1,2]

[1]*School of Engineering, Eastern International University, Binh Duong Province, Viet Nam*

[2]*EIU FabLab Center, Eastern International University, Binh Duong Province, Viet Nam*

hung.nguyenxuan@eiu.edu.vn

Abstract. In this article, conjugate heat transfer performance of a miniature liquid cooling plate was numerically investigated by using chtMultiRegionFoam module in OpenFOAM® (Open-source Field Operation And Manipulation), a computational fluid dynamics (CFD) open source software. The cooling plate was designed using aluminum with an array of pin-fins mounted in liquid bypassing regions. The effects of the configuration of the pin-fin on the heat transfer performance and the pressure drop were discussed and evaluated. In this simulation, water was used as working fluid and its flow rates were selected from 0.8 – 8 L/min to have inlet Reynolds numbers in a range of 2376 to 23757 respectively. The heat transfer characterizations were observed at heat dissipation source up to 62.5W/cm3 of power density. At this heat source, the junction temperature between heater and cooling plate was calculated at around 64oC. This proposed design of cooling device can be a potential candidate for the development of a cooling application for high power electronic devices.

Keywords. Liquid cooling plate, pin-fin array structure, high power electronic cooling device, OpenFOAM®, conjugate heat transfer.

ICATSD2A.404

STUDY OF INTEGRATED LED LUMINAIRE TO MEET ENCLOSURE UL 8750 REQUIREMENTS BY WHITE FLAME BARRIER

CUONG-THAI HUNG, LANH-THANH LE, HIEN-THANH LE , THOI-NAM LE
Department of Technology, Dong Nai Technology University, Bien Hoa City, Viet Nam
lethanhlanh@dntu.edu.vn

Abstract. Intelligent LED lighting systems can save up to 80% of energy compared to traditional lighting systems. In this research shown the new design of integrated LED luminaire with white flame barrier is a family of thin flexible insulation made primarily of inorganic materials for electrical insulating flame barrier applications. The experiment result shown that the new design of integrated LED luminaire allowed the LED product to meet enclosure requirements specified in UL 8750 safety standard for LED equipment without using a glass plate, a flame-retardant plastic lens or a based material. The white flame barrier's high reflectivity helped improve light output.

Keywords. LED luminaire, flame barrier, 8750 safety regulation, LED design.

ICATSD2A.405

SUSTAINABLE SOLUTION FOR INDUSTRIAL WASTE FLY ASH FROM THE COAL-FIRED THERMAL POWER PLANT

NGUYEN VIET DUC[1*], DANG HOANG MINH[2], PHAM TRUONG GIANG[3]

[1]*Thuy Loi University, Vietnam*

[2]*Industrial University of Ho Chi Minh City, Vietnam*

[3]*Hai Phong University, Vietnam*

**ducnv@tlu.edu.vn*

Abstract. Currently, in Vietnam, there are twenty-five coal-fired thermal power plants in operation, emitting a total amount of ash and slag of about 13 million tons per year, of which fly ash accounts for 80% to 85%. A vast cultivation area of the country has been occupied for the dumping purpose of fly ash. This paper proposes the use of fly ash from the coal-fired thermal power plant as a supplementary material for the building process of the rural roads, in order to increase people's travel and trade, thereby improving the lives of people in the rural areas. The application of fly ash in the soil stabilization of the rural road was carried out in the pilot experiment at Huu Lung District, Lang Son province. Fly ash was taken from the nearby Na Duong coal-fired thermal power plant. Several mix proportions of local soil, cement and fly ash have been taken into account for the soil stabilization. The test on a series of samples under compression and splitting tensile loading has indicated that fly ash can be used effectively to enhance loading capacity of the pavement layer. This result promises not also to lower the amount of fly ash in the disposing area of the power plant, but also to relieve the environmental impact on people living nearby.

Keywords. Coal-fired thermal power plant, fly ash, rural road, soil stabilization.

ICATSD2A.406

A STUDY OF CYLINDRICAL SYMMETRY OPTIMAL PUMPING CAVITY FOR SOLAR-PUMPED LASER

TOMOMASA OHKUBO[1], EI-ICHI MATSUNAGA[1], THANH HUNG DINH[2], YUJI SATO[3]

[1]*Tokyo University of Technology*

[2] *Kansai Photon Science Institute, National Institutes for Quantum Science and Technology*

[3] *Joining and Welding Research Institute, Osaka University*

ookubotmms@stf.teu.ac.jp

Abstract. Utilizing renewable energies is our huge demand. Especially, solar energy is huge energy irradiated to the earth. Therefore, we propose a solar-pumped laser as a promising device for solar energy utilization. Although the cone-shaped solar cavity which is a secondary concentrator of solar-pumped laser is used in our previous study, the shape of the solar cavity is not optimized. In this study, we developed the new optimization software to design a solar cavity. The software is based on ray-tracing and it calculates the optimal shape of the solar cavity to maximize the total absorbed power into a laser medium. More than 1550 W of absorbed solar power was calculated for the optimized solar cavity using the laser medium whose density of Nd3+ was 1.0 at % whereas that of the traditional cone-shaped solar cavity was 1200 W. Furthermore, the peak absorbed power density of the optimized solar cavity was 0.44 W/mm3 which is 1.3 times larger than that of the traditional cone-shaped solar cavity. Therefore, simply considering the previous study of slope efficiency, the optimal pumping cavity is expected to realize more than 114 W of laser output without an additional concentrator.

Keywords. Nd: YAG, raytracing, renewable energy, solar concentrator.

ICATSD2A.407

GEOMETRICALLY NONLINEAR FINITE ELEMENT ANALYSIS OF FUNCTIONALLY GRADED PLATES USING FIRST- AND THIRD-ORDER SHEAR DEFORMATION THEORY

DUY-THANG VU

Faculty of Civil Engineering, Industrial University of HoChiMinh city, Vietnam

vuduythang@iuh.edu.vn

Abstract. Geometrically nonlinear analyses of functionally graded material (FGM) plates are studied using first- and third-order shear deformation theory with finite element models. A power law distribution is used to describe the variation of material compositions across the plate thickness. Two types of elements are presented, one based on the Reissner-Mindlin first-order shear deformation hypothesis and one based on a third-order theory. The presented finite element implementation is based on a total Lagrangian approach. Numerical results for different thickness ratios and volume fraction indexes with different boundary conditions have been presented. It is demonstrated that the difference between both elements becomes more obvious when thicker plates are considered.

Keywords. Computational mechanics, FGM plate, shear deformation theory, finite element.

ICATSD2A.408

AUGMENTED AND VIRTUAL REALITY TOOLS TO REDUCE THE ENVIRONMENTAL IMPACT OF AERONAUTICS

A.BERNABEO[1], A.CERUTI[2], P.MARZOCCA[3], A.LIVERANI[2]

[1]*Royal Melbourne Institute of Technology, Vietnam*

[2]***** *University of Bologna, Italy*

[3]*Royal Melbourne Institute of Technology, Australia*

Abstract. This research offers the authors' views on how Augmented Reality (AR) and Virtual Reality (VR) can support the aviation sector, increasing its efficiency and reducing the environmental impact. Since decarbonization is nowadays a business priority, as are developing alternatives and the implementation of environmentally sustainable practices, the path to meeting 2050 emission reduction targets remains challenging. We know that aviation also contributes to non-carbon dioxide climate effects in the atmosphere and despite recent studies highlighting these effects, more robust research is required to provide further guidance on how best to tackle these impacts.

Virtual reality technology is using computers to simulate a three-dimension space and a virtual world, providing simulations of visual, auditory, tactile senses for user and creating a real immersive experience. Since users can observe things in three-dimension in real time without being limited, we will demonstrate that, in particular, the use of Augmented Reality integrated with the popular artificial intelligence (AI) for remote maintenance to make sure aircraft aren't grounded from technical issues, can provide smart system inspections and train maintenance professionals on how to perform important maintenance procedures effectively and accurately. Utilization of the AR not only replaces classic manual training, but also provides high mobility pre-training opportunities. By using AR and AI, traditional standard operation procedures (SOP) can be visualized and standardized.

At the same time, the applications of Virtual Reality to pilots' training, could offer remarkable advantages such as reducing environmental pollution and the movement of aviation professionals around the globe for maintenance or training, thus saving money and reducing pollution from airplanes.

Keywords. Artificial Intelligence (AI), Augmented Reality (AR), Decarbonization, Greenhouse gases (GHG), HoloLens 2, Maintenance, repair and operations (MRO), Standard Operating Procedures (SOP), Virtual Reality (VR).

ICATSD2A.409

THE ENVIRONMENTAL IMPACT OF ADDITIVE MANUFACTURING ON THE AVIATION INDUSTRY

ALESSANDRO CERUTI[1], ALBERTO BERNABEO[2], PIER MARZOCCA[3], ALFREDO LIVERANI[1]

[1]DIN Department, University of Bologna, Italy

[2]RMIT University, Vietnam,

[3]RMIT University, Australia;

alessandro.ceruti@unibo.it, alberto.bernabeo2@rmit.edu.vn, pier.marzocca@rmit.edu.au, alfredo.liverani@unibo.it

Abstract. This paper offers the authors' view on the impact of Additive Manufacturing (AM) on commercial airplanes. While AM production of aircraft parts is increasing with time, aeronautical regulations limit their application to non-structural elements. Parts obtained through AM can be designed using multi-disciplinary design and topology optimization techniques leading to significant weight savings. These new parts could be applied to the next generation of commercial aircraft, but also replaced during maintenance operations in existing vehicles. The mass breakdown of a set of commercial airplanes has been modeled, and a simple mathematical model for fuel consumption and CO2 emissions has been implemented. Based on the analysis of several scenarios of the adoption of AM parts and typical transport jet missions, an assessment of CO2 emissions reduction is also offered. Two levels of AM adoption are explored to provide aircraft manufacturers and airlines with different alternatives. The final outcome of this study is that AM can significantly contribute to the reduction of aircraft emissions, therefore, air regulation agencies should issue guidelines to facilitate the adoption of AM structural elements to obtain environmental advantages without impacting flight safety. Short/medium haul airplanes could achieve even more impressive emission savings than wide-body large twin-engine aircraft.

Keywords. Additive Manufacturing, Commercial Aircraft, CO2 emissions, Life Cycle Analysis.

ICATSD2A.410

CONSIDERATION OF FOCAL POINT CONTROL OF CPC FOR PUMPING CAVITY OF SOLAR-PUMPED LASER

HIROZUMI MUNAKATA[1], TOMOMASA OHKUBO[1], EI-ICH MATSUNAGA[1], THANH HUNG DINH[2], YUJI SATO[3]

[1] *Graduate School of Engineering, Tokyo University of Technology*

[2]*Kansai Photon Science Institute, National Institutes for Quantum Science and Technology*

[3] *Joining and Welding Research Institute, Osaka University*

ookubotmms@stf.teu.ac.jp

Abstract. In recent years, solar-pump lasers which directly convert sunlight into lasers have been attracting attention in the realization of a sustainable society. The Solar-pumped laser consists mainly of a Fresnel lens, a pumping cavity, and a laser medium. A pumping cavity is a secondary focusing optics of the solar light to make solar light be absorbed into a laser medium. In this study, we proposed the new pumping cavity using the shape of a CPC (Compound parabolic concentrator) as an internal mirror. The parameters of CPC were optimized by numerical simulation using raytracing. This result suggests that a simple axisymmetric shape such as a cone-shaped cavity is advantageous for achieving high total absorption efficiency. It was also found that the focal position and number change depending on the number and depth of parabolas. As a result of comparison with previous studies, it was found that the dispersion of absorption power density distribution in the xy-plane was about half that of the cone-type pumping cavity.

Keywords. Nd:YAG, raytracing, solar energy, sustainable society.

ICATSD2A.411

EXPERIMENTAL ANALYSIS ON COMBUSTION CHARACTERISTICS OF BIOFUELS BY USING CONSTANT VOLUME COMBUSTION CHAMBER: AN OVERVIEW

MAI THE TAI[1], VO TAN CHAU[2*], TRAN DANG LONG[1]

[1]*Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Viet Nam*

[2]*Industrial University of Ho Chi Minh City (IUH), Ho Chi Minh City, Viet Nam*

[*]*votanchau@iuh.edu.vn*

Abstract. The combustion of fuel inside the cylinder determines the suitability of this fuel type in an internal combustion engine. The heat release rate (ROHR) and combustion pressure indicate the effect of the fuel properties. The constant volume combustion chamber (CVCC) experiment system is applied for simulating the fuel combustion under a wide range of actual diesel engine operating condition via pre-combustion technique. The image recorded of spray flame from the experiment revealed the development of the combustion process, used as a premise for analyzing the engine performance and emissions. This paper presents the novel study investigating on the effect of various biofuels type in CVCC on combustion characteristics at ambient temperature and EGR ratio conditions. The result heat release rate, combustion pressure and flame development corresponding to different type of biofuels were compared. From the mentioned results, a research strategy was developed to investigate the application of available biofuels in Vietnam.

Keywords. biofuels, combustion characteristics, constant volume combustion chamber, diesel engine, shadowgraph technique.

ICATSD2A.412

ANALYZE THE INFLUENCE OF ROAD PROFILES ON THE COMFORT OF PASSENGERS IN SLEEPER BUS

XUAN NGOC NGUYEN[1], VAN NHU TRAN[2], VAN TAN VU[2], TIEN PHUC DANG[1], THANH TAM TRAN[3]

[1]*Industrial University of Hochiminh City, Vietnam*

[2]*Univesity of Transport and Communications, Vietnam*

[3]*Thu Duc College of Technology, Vietnam*

nguyenxuanngoc@iuh.edu.vn, vannhu.tran@utc.edu.vn, vvtan@utc.edu.vn, dangtienphuc@iuh.edu.vn, tranthanhtam@tdc.edu.vn

Abstract. People often used the sleeper bus when moved on long distances. So the vehicle must bring a smooth and comfortable feeling to the passengers. However, this problem was affected by many factors, including road roughness because it caused vibrations for the vehicle. Therefore, the study built a dynamic model of seven degrees of freedom (DOFs) for vehicles using front and rear-dependent suspension systems combined with a stabilizer bar to analyze the effect of this element. The article used the Lagrange method and the International Organization for Standardization (ISO) 2631-1 standard to determine a sinusoidal road profile and class E road profile based on ISO 8608 affect the comfort of passengers through Root Mean Square (RMS) value of vibration acceleration. The simulation results show that when the vehicle moves at 36 km/h on a continuous sinusoidal road profile, grade D and E road, passengers are uncomfortable. The research serve to investigate to improve basic parameters or develop control systems for the vehicle to reduce vibrations for sleeper buses.

Keywords. sleeper bus, vehicle vibration, ISO 2631, ISO 8608, road profile.

ICATSD2A.413

USING THE ANALOGY LEVER METHOD FOR HYBRID TRANSMISSION ANALYSIS

HO THANH THO*, PHAM QUANG DU

Industrial University of Ho Chi Minh City

**hothanhtho@iuh.edu.vn, phamquangdu@iuh.edu.vn*

Abstract. Hybrid vehicles were invented more than a century ago. Hybrid vehicles have developed rapidly in recent times to reduce the pollution by greenhouse gases generated by traffic. A hybrid transmission is an important component in the powertrain of a hybrid vehicle. They enable the vehicle to operate in hybrid modes, which conventional automatic transmissions impossible. The complexity of hybrid transmission configurations combined with the cumbersomeness of the classical formula makes the gear ratio determination and power transmission analysis of the hybrid transmission restricted. Within the scope of this paper, the author will present a new hybrid transmission analysis method. This method will provide easy access to the hybrid transmission for students and researchers with intuitive and simple.

Keywords. hybrid vehicle, hybrid transmission, gear ratio, power flow, analogy lever method.

ICATSD2A.414

EQUIVALENT-INPUT-DISTURBANCE-APPROACH-BASED DUCT-NOISE CONTROL CONSIDERING HUMAN AURAL CHARACTERISTICS

KAZUMA TAMURA[1], ZEWEN WANG2[,3,4,] JINHUA SHE[1]

[1]*Graduate School of Engineering, Tokyo University of Technology, Japan*

[2]*School of Automation, China University of Geosciences, Wuhan 430074, China*

[3]*Hubei Key Laboratory of Advanced Control and Intelligent Automation for Complex Systems, Wuhan 430074, China*

[4]*Engineering Research Center of Intelligent Technology for Geo-Exploration, Ministry of Education, Wuhan 430074, China*

g512104428@edu.teu.ac.jp, wzw_wangzewen@qq.com, she@stf.teu.ac.jp

Abstract. Low-frequency noise not only causes psychological distress to people but also causes psychological disorders, which affect their health and daily life. Active noise control provides us with a way of suppressing low-frequency noise. It generates a sound of the same amplitude and opposite phase as noise and uses it to cancel the noise. This paper uses equivalent-input-disturbance (EID) method to suppress the low-frequency noise with a ducted system. A low-order ducted model is obtained through identification in the frequency domain. The control system is constructed based on the EID approach with a low-order controller. An equivalent input disturbance is a control-input signal that has the same effect on the output of a plant. An equal-loudness contour is used as a performance index to evaluate the noise-suppression effect of the system, which represents the human-aural characteristics. The parameters of the control system are designed by considering human-aural characteristics. Simulation results show that the noise is reduced by 60%, which demonstrates the validity of the method.

Keywords. active-noise control, control system, equivalent input disturbance (EID), human-aural characteristic.

ICATSD2A.415

OPTIMIZATION OF MONOCOQUE BUS BODY FRAME STRUCTURE

NGUYEN THANH TAM, NGUYEN VAN SY, NGUYEN CONG THANH, PHAM QUAN DU
Industrial University of Ho Chi Minh City,Viet Nam
nguyenthanhtam@iuh.edu.vn

Abstract. This study optimizes monocoque frame structures produced in Vietnam under static loads. The finite element model and analytical simulation of the slayer skeletal system are performed by CATIA and ALTAIR OPTISTRUCT software. The static analysis of bus frame structures is carried out with different boundary and loading conditions as bending, tossing, braking, cornering. The actual simulation calculation results show that the right torsion process has a stress value greater than the permissible value of 13.3%, the largest displacement of the left torsion process at the front windshield is greater than the permissible value of 47%. After that, the finite element static analysis on the new body structure with Taguchi method application conducts structural experimental design, using Particle Swarm Optimization algorithm (PSO) to perform structural optimization. The results obtained in optimization showed that stress and deformation satisfy with the standard. The weight of the chassis is reduced compared to the original. Finally, an optimal solution of set is chosen as the final design.

Keywords: bus structure, finite element, simulation, static analysis, optimization

ICATSD2A.416

DESIGN OF REINFORCED PILLAR FOR THE IMPROVEMENT OF BUS ROLLOVER CRASHWORTHINESS

NGUYEN VAN SY, NGUYEN THANH TAM, NGUYEN CONG THANH

Faculty of Vehicle Technology, Industrial University of Ho Chi Minh City

nguyenvansy@iuh.edu.vn, nguyenthanhtam@iuh.edu.vn, nguyencongthanh@iuh.edu.vn.

Abstract. It is important to consider the performances of strength and rollover safety after the accident that the deforming superstructure seriously threatens the lives of the passengers. Thus, the stiffness of the bus pillar is the first thing that needs to be considered. This paper presents an finite-element analysis analysis method with which to design the monocoque bus frame section for a reduction in occupant injuries from rollover accident. First, the design of experiment of three point pending and bus section rollover were conducted to compare the agreement of the finite-element analysis method. The finite element model of the monocoque bus frame section is verified against the experiment method which showed a pretty good agreement. Then the rollover accident analysis of reinforced-allum method was done according to the safety rules of the European standards (ECE-R66). The results showed that the survival spaces for the passengers were secured against rollover crashworthiness of the monocoque bus frame section.

Keywords. reinforce, bus frame, finite element, simulation, dynamic analysis.

ICATSD2A.417

REHABILITATION METHODS FOR CORROSION-INDUCED DAMAGE IN REINFORCED CONCRETE STRUCTURES

DONG VIET PHUONG TRAN[1], MIEN VAN TRAN[2], PAKAWAT SANCHAROEN[3], PITICHON KLOMJIT[4], SOMNUK TANGTERMSIRIKUL[3]

[1] *Industrial University of Ho Chi Minh City, Ho Chi Minh City,Viet Nam*

[2]*Ho Chi Minh City University of Technology (HCMUT), Viet Nam*

[3]*School of Civil Engineering and Technology, Sirindhorn International Institute of Technology, Thammasat University, Thailand*

[4]*National Metal and Materials Technology Center, Thailand*

tranvietphuongdong@iuh.edu.vn

Abstract. Corrosion of reinforcement, which is caused by either chloride attack or carbonation, reduces the performance of the reinforced concrete (RC) structures. Three rehabilitation techniques are evaluated in this paper, i.e. chloride removal, carbon fiber reinforced polymer wrapping, and patching repair. These repair techniques have different approach in term of handling the chloride ions. The corrosive substance is either extracted from the concrete layer or constrained it to penetrate into the concrete layer. In the perspective of electrochemical aspect, all three techniques increase the corrosion potential of reinforcement significantly. In other words, the probability of corrosion of reinforcement decreases after applying those repair methods.

Keywords. rehabilitation, chloride removal, CFRP wrapping, patching repair, reinforcement, concrete.

ICATSD2A.418

EFFECT OF MANUFACTURED SAND QUALITY ON THE REINFORCED CONCRETE STRUCTURAL BEHAVIOR: STATE OF ART

DO TRONG THANH1, TONG TON KIEN[2], LE VIET DUNG[3*]

[1]*PhD student, Faculty of Civil and Industrial Engineering, Hanoi University of Civil Engineering*
[2]*Faculty of Building Material, Hanoi University of Civil Engineering*
[3]*Faculty of Civil and Industrial Engineering, Hanoi University of Civil Engineering*

**dunglv@huce.edu.vn*

Abstract. In this paper, the effect of different type of manufactured sand on the concrete quality applied for the reinforced concrete (RC) structure was investigated. A state of experimental set was summarized basing on the series test, includes the: (i) compressive test of cube specimen to determine the compressive strength, (ii) compressive test of cylinder specimen to determine the elasticity modulus, (iii) pull-out test to determine the bond strength between concrete-reinforcement and, (iv) axial compressive test of reinforced concrete column. The experimental data obtained with RC structure using the manufactured sand was compared with that using the natural sand. The comparison results clarified the considerable fluctuation of compressive strength of the concrete and concrete structure using the manufactured sand. This state of art required the necessary of an extended analyze of time-depending bahaviour of RC structures using the different type of manufactured sand.

Keywords. manufactured sand; Natural sand; Reinforced concrete structure; Pull-out test; Axial loading.

ICATSD2A.419

DESIGN AND SIMULATION OF AN INDEPENDENT THREE-PHASE INVERTER CONTROL SYSTEM ON THE DQ COORDINATE SYSTEM

PHUONG-VU HOANG[1], LANH-THANH LE[1], THOI-LE NAM[1,2]

[1]*Dong Nai Technology University, Viet Nam*

[2]*Binh Duong Trade Union Technical and Professional Vocational School, Viet Nam*

Abstract. In this paper, the analysis calculates the output voltage of each phase in Matlab-Simulink simulated waveform. Study using Matlab-Simulink tool to simulate and evaluate the voltage losses, considering the effect in the operation time of sinusoidal pulse width modulation. The simulation results peak voltage is 311V with the input voltage is 220V that shown the correction over peak voltage is 7%. The result of THD value is 0.37% that proved the designed has small harmonic distortion.

Keywords. Matlab-Simulink, Three-phase inverter, Controller, Voltage.

ICATSD2A.420

AN EXPERIMENTAL STUDY ON SETTLEMENT BEHAVIOR OF SOFT DEPOSITS IMPROVED BY NATURAL DRAIN

THI PHUONG LINH NGUYEN[1, 2], MINH HOANG TRAN[3], TAN HUY NGUYEN[1], TAN PHAT NGUYEN[1], BA-PHU NGUYEN[1], *

[1]*Department of Civil Engineering, Industrial University of Ho Chi Minh City,Vietnam*

[2]*PhD student, Department of Civil Engineering, Ho Chi Minh City Open University,Vietnam*

[3]*Faculty of Civil Engineering, Ton Duc Thang University, Vietnam*

nguyenbaphu@iuh.edu.vn

Abstract. It is well-known that prefabricated vertical drains (PVDs) were commonly used to accelerate the consolidation process of soft deposits. The recent studies presented that this soft soil improvement method can impact the environment because the emissions can create significantly in PVD production and installation. Therefore, it is necessary to apply natural fibers (e.g., coir), which are waste materials, as a reasonable alternative to synthetic materials. Drains can be made from these natural fibers, then it can be called natural drains. This is not only an environmentally friendly material but also degrade biologically over time in the subsoil under the embankment. In recent years, although natural drains have received considerable attention, there are very few experimental studies to estimate the natural drain's applicability. Therefore, the aim of this study is to carry out a series of experimental tests to investigate the consolidation settlement behavior of natural drain-installed soft deposits. To estimate the natural drain's applicability, three consolidation tests of the soil column are carried out, in which the first soil column is installed by the natural drain, the second soil column is installed by PVD and the drain is not installed on another one. In this study, the natural drain is made from waste coir fibers. The results show that the consolidation settlement of soft soil in the case with natural drain installation are larger than those in other cases at a given time. Therefore, this indicated that the natural drain can apply in the soft soil improvement field.

Keywords. soft deposit, natural drain, consolidation, settlement, vertical drain.

ICATSD2A.421

TOPOLOGY OPTIMIZATION OF PLATE STRUCTURE USING PREDETERMINED-SHAPED HOLES

TRUONG THANH CHUNG, NGUYEN THANG XIEM, LE NGUYEN ANH VU, HO CHI HAN

Nha Trang University

chungtt@ntu.edu.vn

Abstract. Optimizing the structure to achieve the best performance is an important goal of structural engineering. One approach is using topology optimization to determine the optimal distribution of material. This approach leads to numerous applications with structures that look like growing from trees. However, topology optimization often leads to complex shapes, which are neither cost-effective nor practical to manufacture. Many studies have devoted to seek solutions for this issue of manufacturability, for both traditional and additive manufacturing processes. In this paper, we describe a method to achieve the optimum topology for a rectangular plate with two opposite sides simply supported and other sides free. First, shape optimization is performed to find the optimum shape curve of the plate. Second, based on that optimum curve, the void density function is calculated along the beam axis. And third, the configuration of holes distribution is mapped using the calculated void density function. To address the issue with manufacturability, we only use predetermined-shaped holes to remove material from the plate.

Keywords. topology optimization, shape optimization, manufacturability, plate.

ICATSD2A.422

STRESS ANALYSIS FOR THE SPINDLE OF A FILAMENT WINDING MACHINE USING MDSOLIDS

TRIEU KHOA NGUYEN*, MANH HAI BUI, VAN HUY LE, VAN KHANH NGUYEN, HUU PHUOC DANG, ANH PHONG NGUYEN

Faculty of Mechanical Engineering, Industrial University of HoChiMinh City, Vietnam

**nguyenkhoatrieu@iuh.edu.vn*

Abstract. MDSolids won the best teaching software award in the 1998 educational software competition, with a friendly interface and features. The software was built based on many books of mechanics of materials of many reputable authors and has been used by many universities around the world. This paper presents the basic features of MDSolids and its application in stress analysis for the spindle of a filament winding machine. The results showed that the software helped students to verify the calculation results. At the same time, stress and moment diagrams were also visually illustrated, and easy to understand. The results of this study can contribute to enhancing the application of MDSolids in teaching and learning of courses of Strength of Materials in Vietnam.

Keywords. Stress analysis, Strength of materials, Spindle, Filament winding machine, MDSolids, CLIL.

ICATSD2A.423

THE APPLICATION OF ANSYS FLUENT IN DESIGN OF HEATING, VENTILATING AND AIR-CONDITIONING SYSTEM

TRAN DINH ANH TUAN[1] , NGUYEN THI KIM LIEN[1], NGUYEN THANH NHAN[2], NGUYEN THI NGUYET[2]

[1]Faculty of Heat and refrigeration engineering, Industrial university of Ho Chi Minh City

[2]KYODO CO., LTD

trandinhanhtuan@iuh.edu.vn, nguyenthikimlien_nl@iuh.edu.vn, nhanhvac189@gmail.com, nguyetnguyen221198@gmail.com

Abstract. High-performance of engineering design for the heating, ventilating and air-conditioning (HVAC) system is synonymous with high-performance buildings. The application of a simulation technique, which can simultaneously predict airflow, heat transfer and contaminant transportation in and around buildings has substantially improved the design of energy efficient HVAC systems. This article proposed the computational fluid dynamics (CFD) with k-ε turbulence mode to simulate and evaluate the distribution of temperature and airflow, impact of the size of supply air grill (SAG) for the building in Vung Tau city. The results show that the existing design does not respond well to the uniform distribution of airflow and temperature zones, which are crucial factors of design criteria in HVAC system. Since then, the study has proposed to change the method of air supply from vertical to horizontal, and replace the round SAG with the square SAG to achieve design criteria suitable with the structure of this building. Through the analysis of this study, it shows that CFD has the ability to predict possible design limitations, thereby helping to reduce construction costs.

Keywords. Airflow; Ansys fluent; HVAC; Temperature; Turbulence models.

ICATSD2A.424

APPLICATION OF ADAPTIVE FUZZY ALGORITHM IN OPTIMIZING SPEED AND VIBRATION FOR A BIAXIAL MOTION AGV SYSTEM

VAN-Y HUYNH[1], NGOC-BICH LE[2], XUAN-HUNG NGUYEN[1], DUC-CANH NGUYEN[1], MANH-KHA KIEU[3], TRAN-THUY-DUONG NINH [3], VU-ANH-TRAM NGUYEN[3], NARAYAN C. DEBNATH[4], NGOC-HUAN LE[1]

[1] *School of Engineering, Eastern International University, Thu Dau Mot, Binh Duong, Vietnam*

[2] *School of Biomedical Engineering, International University - Vietnam National University, Ho Chi Minh City, Vietnam*

[3] *Becamex Business School, Eastern International University, Thu Dau Mot, Binh Duong, Vietnam*

[4] *School of Computing and Information Technology, Eastern International University, Thu Dau Mot, Binh Duong, Vietnam*

huan.le@eiu.edu.vn, lnbich@hcmiu.edu.vn

Abstract. Motion control is an essential part of industrial machinery and production systems. In this paper, the Adaptive Fuzzy controller is proposed to optimize the velocity and vibration during the two-axis motion of the automatic guided vehicle (AGV). Theoretical analysis, as well as simulation, shows that, during the simultaneous motion of two axes of the AGV, when the speed of each axis has not been changed according to the adaptation, the motion of the AGV will be shaken strongly due to sudden stops. From the foregoing and the study process, the Adaptive Fuzzy algorithm proved suitable for this application. The intelligent position controller that combines the advantages of Adaptive Fuzzy control with the powerful features and learning ability to monitor the periodic command of the servo drive mechanism has been introduced. The computer simulation results show that the Adaptive Fuzzy controller achieves twice as much as without using the algorithm the best motion performance for the AGV, not only that but also reduces vibration to close to 0, during motion greatly.

Keywords. Adaptive Fuzzy, Smart WareHouse, AGV, Vibration.

ICATSD2A.425

APPLY A* ALGORITHM TO OPTIMIZE THE TIME AND ENERGY OF PICKING/RETURNING GOODS IN SMART FACTORY

VAN-Y HUYNH[1], NGOC-BICH LE[2], XUAN-HUNG NGUYEN[1], DUC-CANH NGUYEN[1], MANH-KHA KIEU[3], TRAN-THUY-DUONG NINH[3], VU-ANH-TRAM NGUYEN[3], NARAYAN C. DEBNATH [4], NGOC-HUAN LE[1]

[1] *School of Engineering, Eastern International University, Thu Dau Mot, Binh Duong, Vietnam,*

[2] *School of Biomedical Engineering, International University - Vietnam National University, Ho Chi Minh City, Vietnam,*

[3] *Becamex Business School, Eastern International University, Thu Dau Mot, Binh Duong, Vietnam,*

[4] *School of Computing and Information Technology, Eastern International University, Thu Dau Mot, Binh Duong, Vietnam.*

huan.le@eiu.edu.vn, lnbich@hcmiu.edu.vn

Abstract. Distribution companies often store goods in large warehouses. Orders are collected and prepared for shipping. Large-scale warehouses are often divided into different industries. Each operator collects and processes a portion of orders from the assigned area. In that case, the operator often chooses small orders and applies an unoptimized storage and dispatch process, which leads to many errors and low performance. Currently, in the 4.0 revolution, the application of technologies in production, especially in the logistics industry, is a top priority. A smart warehouse is one of them. In order for the warehouse to be truly smart, it is necessary to optimize the process of arranging goods and reduce labor. In this paper, the author applies the A* algorithm to optimize the warehousing process. The simulation results demonstrate that the A* algorithm has amazingly optimized the process of storing and exporting. Specifically, the results show that applying the A* algorithm improves performance significantly and achieves the highest performance when sorting up to 60% of the goods. As a result, the system operates more flexibly, reducing time and energy in the process of storing and exporting.

Keywords. A Star, Smart WareHouse, AGV, Path planning, Optimization.

ICATSD2A.426

A SIMULATION INVESTIGATION OF INFLUENCE OF CUTTING PARAMETERS ON TEMPERATURE AND CUTTING FORCE IN HIGH SPEED MACHINING OF TITANIUM ALLOY

THANH-DANH LAM, ANH-PHI BUI, DUC-NAM NGUYEN*

Faculty of Mechanical Engineering, Industrial University of Ho Chi Minh City,

**nguyenducnam@iuh.edu.vn*

Abstract. Titanium alloys have been widely used in the aerospace and biomedical fields, due to their high hardness and good mechanical properties. However, machining these hard materials is difficult for machines due to their high strength, low thermal conductivity and high chemical reactivity at high temperatures. When the machining parameters are not selected appropriately, the surface quality of the product does not meet the technical requirements. Therefore, determining the appropriate machining parameters is necessary to improve the quality of the product during the machining process, especially in the high-speed machining (HSM) environment. In this study, the high speed machining (HSM) simulation of Ti-6Al-4V workpiece using carbide tool coated with TiCN has been established with different combination of cutting conditions for prediction of main cutting force and temperature. The parametric variation shows that depth of cut and tool rake angle are influencing parameters on cutting force. In addition, the increase in cutting speed and tool rake angles increases the temperature in the cutting zone. Based on the simulation results will be helpful for establishing more favorable experimental conditions and reducing the machining time and cost.

Keywords. Titanium alloys, cutting force, high speed machining (HSM), temperature, tool rake angle, cutting speed, depth of cut.

ICATSD2A.427

SPAN EFFICIENCY OF A FREE-FLYING DRAGONFLY WITH/WITHOUT FOREWING

RYUSUKE NODA

Department of Mechanical Engineering,, Tokyo University of Technology, Japan

nodarysk@teu.stf.ac.jp

Abstract. Several methods have been proposed to express flight efficiency in flapping flight; the efficiency of lift production, span efficiency, can be widely used as an index of flight efficiency for comparing various flying animals with different aerodynamic force production mechanisms. However, in the case of some insects with tandem wings, the conventional method for calculating span efficiency is based on direct measurement of a wake, making it difficult to calculate the span efficiency independently for the fore- and hindwings. In this study, the span efficiency of a free-flying dragonfly was calculated using the results from a computational fluid analysis. The span efficiency was determined separately based on the lift distribution across the span of the fore- and hindwings. The span efficiency of the hindwings was found to be greater than that of the forewings. Furthermore, by comparing the results between the tandem and solo flights of the hindwings, the effect of the wing-wing interaction can improve instantaneous span efficiency even if it works poorly for enhancing lift force production. These results allow for a detailed examination of the flight performance of a dragonfly, and the proposed method could be applied to other insects with tandem wings.

Keywords. dragonfly flight, flapping wing, span efficiency, tandem wings.

ICATSD2A.428

SIMULATION OF OXY-FUEL CIRCULATING FLUIDIZED BED COAL COMBUSTION

HOANGKHOI NGUYEN, THANH BUI TRUNG, HOAI DINH NHAT LE
Faculty of Heat and Refrigeration Engineering, Industrial University of Ho Chi Minh City
nguyenhoangkhoi@iuh.edu.vn, buitrungthanh@iuh.edu.vn

Abstract. Oxy-fuel circulating fluidized bed is a potential technology for carbon dioxide capture from coal-fired power plants for the target of zero-emission power stations. This paper aimed to investigate the behaviors of an oxy-fuel circulating fluidized bed combustion (CFBC) for CO2 capture, using simulation modeling. The model used the principles of mass and energy balances and the chemical reactions kinetics of coal firing. Under various oxygen feeding levels of 21 vol.% to 29 vol.%, the combustion characteristics were predicted, including flue gas concentration (CO2, H2O, CO, SO2, NO), and temperature in the combustor. In addition, a theoretical combustion efficiency was also estimated for oxy-fuel coal combustion. Simulation results were validated with experimental results obtained from the 0.1 MWth Oxy-CFBC test rig, indicating a good agreement. The proposed model can be used as a numerical reference for the design and operation evaluation of oxy-coal power stations.

Keywords. combustion, CFBC, oxy-fuel, mass and energy balances, simulation, flue gas..

ICATSD2A.429

DEVELOPMENT OF INTERIOR ACOUSTIC CONTROL SYSTEM FOR ULTRA-COMPACT ELECTRIC VEHICLE: ANALYTICAL STUDY ON OUTPUT PERFORMANCE OF GIANT MAGNETOSTRICTIVE ACTUATOR

TARO KATO[1]*, KEIGO IKEDA[2], AYATO ENDO[3], HIDEAKI KATO[4], TAKAYOSHI NARITA[4], MITSUAKI FURUI[1]

[1]*Department of Mechanical Engineering, Tokyo University of Technology*

[2]*Department of Mechanical Engineering, Hokkaido University of Science*

[3]*Department of Electrical Engineering, Fukuoka Institute of Technology*

[4]*Department of Prime Mover Engineering, Tokai University*

katohtr@stf.teu.ac.jp

Abstract. The United Nations Sustainable Development Summit adopted 17 sustainable development goals (SDGs) in 2015. The 17 SDGs include reducing casualties from road accidents globally, developing transportation systems that have less impact on the environment, expanding public transportation, and improving transportation safety by considering persons with disabilities and the elderly. Traditional transportation and mobility tools have been reviewed to achieve these goals. New transportation systems and vehicles have been continuously developed in the automobile industry. Recently, the ultra-compact electric vehicle (EV) has been introduced to the market as an alternative to vehicles that use gasoline engines. However, because the outer plate of an ultra-compact EV has low rigidity, the road noise generated by tires during rotation and the wind noise generated from the projection shape of the vehicle are transmitted to the inside of the vehicle. It is believed that this interior noise causes passenger ride discomfort. In a previous study, an active control system was investigated for noise transmitted from the outside. It uses a control sound generated by a giant magnetostrictive actuator on the wall surface in the cabin instead of a speaker installed in the vehicle. In this system, the control sound from the wall surface in the cabin is generated by the giant magnetostrictive actuator. The output control sound forms a giant magnetostrictive actuator that requires sufficient thrust, less distortion, and a delay in the sound wave. Therefore, in this study, the quality of the output sound from the giant magnetostrictive actuator affected by a biased magnetic field in the actuator was investigated using electromagnetic field analysis.

Keywords. active noise control, electromagnetic field analysis, giant magnetostrictive actuator, ultra-compact electric vehicle.

ICATSD2A.430

NUMERICAL SIMULATION THE EFFECT OF HELMETS ON AERODYNAMIC CHARACTERISTICS OF CYCLISTS

TIEN PHUC DANG, XUAN NGOC NGUYEN
Industrial University of Hochiminh City, Vietnam,
dangtienphuc@iuh.edu.vn, nguyenxuanngoc@iuh.edu.vn

Abstract. Aerodynamic drag is one of the main causes of significant influence on competitive cyclists. This paper studies the aerodynamic characteristics of aero helmet and standard helmet by using Ansys software. The results of the numerical simulations were obtained using Reynolds-averaged Navier-Stokes (RANS) equations with Realizable $k-\varepsilon$ model. The magnitude of the velocity, static pressure and the flow field structure of two models are presented in this paper. The obtained result of drag coefficient (Cd) of aero helmet is 0.207 and standard helmet is 0.401. It is shown that the aero helmet always less drag in comparison with standard helmet. The research results are presented graphically and help better understand how the effect of the helmet shape on the aerodynamic characteristic as well as the pressure and velocity distribution around the helmet model.

Keywords. CFD simulation, aerodynamics, aero helmet, drag coefficient, RANS.

ICATSD2A.431

APPLICATION OF COLD STORAGE TECHNOLOGY AND USE OF DYNAMO OPTIMIZING 3D REVIT DRAWINGS DESIGN FOR BUILDINGS GOLDLAND PLAZA TRADE CENTER

CAO TRUNG HAU, NGUYEN DUC PHAP, NGUYEN THI TUYET NGAN, NGUYEN THANH NHAN, NGUYEN DINH KHAI

Faculty of Heat And Refrigeration Engineering, Industrial University Ho Chi Minh City

caotrunghau@iuh.edu.vn, ngducphap84@gmail.com, tuyetngan247@gmail.com, 18050171.nhan@student.iuh.edu.vn, 18075511.khai@student.iuh.edu.vn

Abstract. Energy is extremely important in daily life as well as production, so now for refrigeration systems, there is a need for energy saving and cold storage is one of those methods. Cold storage technology is an effective technology not only in saving energy but also in improving system performance, especially large capacity refrigeration systems. In the era of 4.0 technology, 3D drawings are strongly developing in many fields in general and in the field of ventilation and air conditioning in particular, in which the Dynamo tool is an "effective arm" to support 3D drawing. Dynamo helps to simplify and automate drawing steps using functions and programming languages, and 3D drawing implementation steps will shorten time and increase installation accuracy for the system. Besides Dynamo, CFD is a software used to simulate air flows and heat flows in equipment, thereby providing solutions, specific demonstrations for installation and possible problems. Therefore, in this study, the research team combined all three of the above applications into the design of the air conditioning system for the GoldLand Plaza trade center. The results show that, when applying cold storage technology, 35% of the total cost of electricity, operation and maintenance is saved. Save about 40% of the total time to design 3D drawings with Dynamo application compared to traditional design methods. CFD simulations helped uncover cooling problems and uneven heat distribution in the mall.

Keywords. Cold storage, Revit, Dynamo, CFD.

ICATSD2A.432

OPTIMAL DESIGN OF A NON-ACCUMULATOR FLOW-MODE MAGNETO-RHEOLOGICAL SHOCK ABSORBER FOR VEHICLE APPLICATIONS

QUOC-DUY BUI *, HUU-QUAN NGUYEN, LONG, VUONG HOANG, QUOC HUNG NGUYEN*

Faculty of Mechanical Engineering, Industrial University of Ho Chi Minh City, Ho Chi Minh City, Vietnam,

**buiquocduy@iuh.edu.vn, nguyenhuuquan@iuh.edu.vn, hoanglongvuong@iuh.edu.vn, *nguyenquochung@iuh.edu.vn*

Abstract. This research work aims at an optimal design of a new flow–mode magneto–rheological (MR) shock absorber (SA) for vehicle applications. As compared with conventional flow–mode MRSAs, which usually employ a gas chamber functioning as an accumulator to accommodate the volume change, the proposed MRSA replaces this accumulator with a geometrical constraint of design dimensions. By this way, the structure of the new MRSA is more compact and favorable to manufacturing and maintenance, which can significantly reduce production cost of the SA for practical development. First of all, dynamic modeling of vehicle suspension systems is presented and the proposed MRSA is configured. An optimization procedure based on finite element analysis (FEA) is then conducted considering the damping force, dynamic range, and inductive time constant of the damper. From the optimal solutions, discussions on the performance of the proposed MRSA are subsequently undertaken and its quasi–static behavior is predicted under different current excitations.

Keywords. accumulator, flow–mode, magneto–rheological (MR), optimal design, shock absorber, vehicle.

ICATSD2A.433

APPLICATION CFD & VIRTUAL REALITY (VR) TECHNOLOGY FOR CALCULATION TESTING OF AIR CONDITIONING SYSTEMS

CAO TRUNG HAU, TRAN MINH CHON, LE MINH GIA HUY, NGUYEN QUOC HOANG, DANG DUNG NGHIA, BUI LAC TUAN

Faculty of Heat and Refrigeration Engineering, Industrial University Ho Chi Minh City

caotrunghau@iuh.edu.vn, chonminh123@gmail.com, leminhgiahuy99@gmail.com,

nguyenquochoangenglish@gmail.com,nghianhodhnl14b@gmail.com,builactuan1410@gmail.com

Abstract. CFD has an important role and is applied in all fields. Incorporating CFD simulation in HVAC results in savings in operating time, costs, and energy, while improving specifications. CFD simulation will be one of the effective support tools in the process of calculating, designing and testing the HVAC system, ensuring the criteria of green building and sustainable development. The combination of CFD simulation with virtual reality (VR) technology by SIMLAB software simulates the output of CFD results in virtual space (VR). The application of CFD and SIMLAB to the calculation and design of ventilation and air conditioning systems will contribute to increasing the efficiency and speed of work during the design phase for engineers, and at the same time. helping customers have a realistic view of the HVAC system before and after operation.

Keywords. CFD, SIMLAB, VR, HVAC.

ICATSD2A.434

PYROLYSIS CHARACTERISTICS OF SOME SOLID FUELS IN A FLUIDIZED BED REACTOR

HOANG KHOI NGUYEN, THANH QUANG NGUYEN, QUANG PHU PHAM

Faculty of Heat and Refrigeration Engineering, Industrial University of Ho Chi Minh City

nguyenhoangkhoi@iuh.edu.vn, nguyenthanhquang@iuh.edu.vn

Abstract. Fluidized bed technology has been widely used for the treatment of solid fuels and waste by combustion or gasification, promising solutions for thermal power or electrical generation. This paper presents experimental results for pyrolysis characteristics of lignite, municipal waste, sludge, wood pellet, and bagasse pellet in a lab-scale fluidized bed. The effect of temperature on the pyrolysis properties was investigated in the ranges of 350, 450, 550, 650, 750, and 850 °C. The results obtained indicate that CO concentration and light hydrocarbon gas increased with temperature during pyrolysis, meanwhile, CO_2 content and heavy hydrocarbon gas decreased. The fixed carbon content was highly dependent on temperature during pyrolysis, similar to the theoretical analysis result at above 700 °C. For biomass fuels, mainly heavy oil and water were mainly emitted at temperatures around 500 °C. In the case of lignite and wood co-pyrolysis, some gases were also released at high temperatures. The consistency of fuel composition plays a crucial role in determining the pyrolysis properties of mixed fuels in fluidized bed reactors. The results obtained in this study would be as a reference database for modeling validation and development of the co-firing process in fluidized bed combustors.

Keywords. Solid fuels, pyrolysis, fluidized bed, syngas composition, sludge, biomass.

ICATSD2A.435

DESIGN PROCESS OF ELECTRIC VEHICLE BATTERY SYSTEM

PHAM XUAN MAI[1], TRUONG THANH HAI[2], LE HOANG PHU PHAM[3], NGUYEN CHI HUNG[1]

[1] *Industrial University of Ho Chi Minh City, Vietnam*

[2] *Thaco Group, Vietnam,*

[3] *Catholic University of America, USA*

pmai_2002@yahoo.com

Abstract. Battery Electric Vehicle (BEV) is a major trend of car manufacturers around the world, in which the battery system is the most important and expensive component providing energy for BEV operating. This paper presents the design and simulation process of BEV battery system based on the Siemens Simcenter software. This process includes design and simulation of battery cell, battery packs and battery system, including the calculation of the features, the thermal management system to help maintain a stable temperature. This will help improve the output efficiency, improve the charging and discharging efficiency, performance and stability, safety of the battery system on BEV and is used to evaluate the overall battery system. A complete battery system designed by this process will be connected to a vehicle dynamics model to evaluate performance under specific operating conditions. Based on this process, the designer can optimally incorporate the battery system into the overall design of the BEV.

Keywords. BEV, battery cell, battery packs, battery system, simulation, design process.

ICATSD2A.436

THE TECHNIQUE OF REFINED SALT DRYING ON A CONTINUOUS FLUIDIZED BED DRYER

BUI TRUNG THANH*, PHAM QUANG PHU, NGUYEN HOANG KHOI

Faculty of Heat and Refrigeration Engineering, Industrial University of Ho Chi Minh City

**buitrungthanh@iuh.edu.vn,phamquangphu@iuh.edu.vn, nguyenhoangkhoi@iuh.edu.vn*

Abstract. The moistly refined salt particles have high cohesive characteristics that get on salt cakes or clumps when dried in the hot gas flow, so people must dry them in the drum dryers attached to ball-tube hammers or vibrators. This paper presented a method of drying refined salt particles in a continuous fluidized bed dryer (CFBD) by arranging a dried refined salt particles layer on its air distributor with supplied hot gas flow at the begin drying stage. The experiment research determined the affection of the fluidized supportable layer height (FSLH) to the fluidization regimes of the dried refined salt drying. The dried particle mass ratio and wet refined salt grains mass were 42% minimum. This experimental research showed the FSLH(H_0) of 65mm with the hot gas velocity (V_g) of 1,3m/s, drying hot gas temperature (t_g) of 160^{O}C and the diameter of refined salt particles (d_p.) within 0,9 < d_p <1,2mm obtained the moist content of the finished product (M_2) was 0,2%, the special heat consumption (SHC) was 4052,05 kJ/kg vapor and the maximum final product recovery efficiency was 91,03%. The specific electrical consumption (SEC) was 407Wh/ kg vapor.

Key words. Refined salt particles drying, continuous fluidized bed dryer, standard moisture content, inert particles layer.

ICATSD2A.437

HYDRODYNAMICS SIMULATION OF A PULSED FLUIDIZED BED FOR THE REFINED SUGAR BY TWO FLUID MODELS

PHAM QUANG PHU[1*], BUI TRUNG THANH[1], LE ANH DUC[2]

[1]*Faculty of Heat and Refrigeration Engineering, Industrial University of Ho Chi Minh City,*

[2]*Faculty of Engineering and Technology, Nong Lam University;*

phamquangphu@iuh.edu.vn, buitrungthanh@iuh.edu.vn, leanhduc@hcmuaf.edu.vn

Abstract. The hydrodynamics behavior of gas and particles with a horizontal pulsed gas jets in a gas-particles bubbling fluidized bed was simulated by 2D Two Fluid Model (TFM). Fluidizating processes of refined sugar with continuous flow, variable velocity and pulse frequency pulsed jet flow on cross-section of the particles layer were simulated. The effect of pulse frequency on the hydrodynamics of the gas and particles was also analyzed. The results showed that the porosity of the bed and the size of the bubbles caused by the pulsed gas jets were greater than that of the continuous fluidization. The fluidizating process of sugar particles will hardly take place in 02 cases, (i) the average speed is lower than 1.0 m/s, (ii) the pulsation amplitude is lower than 0.25 m/s. In case of the average gas velocity 2.0 m/s, the pulsation amplitude 0.5 m/s and the pulse frequency 0.55 Hz, the porosity of the bed reaches the maximum value is 0.617 at 0.47s. In all simulation cases, the bed pressure loss reaches a maximum value of 560 Pa and this value decreases as the fluidizating regime gets better. The granular material fluidizating system with pulsed gas enhances the mixing of gas-particles while reducing gas flow compared to conventional continuous fluidizating system.

Keywords. Fluidizating, pulsed gas jets, hydrodynamics simulation, refined sugar, Two Fluid Model, porosity, pulsation amplitude, pulse frequency.

ICATSD2A.438

BENEFIT ANALYSIS OF GRID-CONNECTED FLOATING PV SYSTEM AT DA MI, BINH THUAN

NGHIA HIEU NGUYEN, AN HOANG VO, THANH TRUNG BUI

Faculty of Heat and Refrigeration Engineering, Industrial University of Ho Chi Minh City, Vietnam,

nguyenhieunghia@iuh.edu.vn, vohoangan4@gmail.com, buitrungthanh@iuh.edu.vn

Abstract. In the step-by-step roadmap of limiting and eliminating power sources using fossil fuel, especially coal-fired power, as well as setting targets for developing renewable energy to replace of the Vietnamese government. The explosion of the solar farm, rooftop solar power, followed by floating solar power considered the best candidate in meeting the goals of land space, PV operation efficiency, meeting the better environmental goal. Along with the rapid development of solar cell technology in the world is the government's incentives and financial support for solar power projects and the water surface area is still very large, floating solar power plants will strongly attract investors in the near future. This study could help stakeholders in the market understand the economic - technical aspects from analyzing economic - financial indicators of floating solar power plants with a capacity of 47.5 MW connected to the national power system 110 kV at Da Mi hydropower reservoir in Binh Thuan province, Vietnam. It was connected to the grid in May 2019. This is the first floating solar power plant on the reservoir in Vietnam, is the property of a third party.

Keywords. Benefit analysis, PV system, solar power, floating solar power plant.

ICATSD2A.439

FINITE ELEMENT METHOD FOR THE MODEL PARAMETER EXTRACTION IN APPLICATION TO FACE-SHEAR MODE SQUARE MEMS RESONATOR

TAN-LOC NGUYEN, ANH-VINH NGUYEN, HUNG LE-VAN

Industrial University of Ho Chi Minh City

nguyentanloc@iuh.edu.vn, nguyenanhvinh@iuh.edu.vn, levanhung@iuh.edu.vn

Abstract. A new method for calculating and extracting model parameters for a square MEMS resonator is presented in this paper. This work also proposes a second-mode shape design based on the fundamental Face-Shear form resonator. The equivalent circuit including L_x, C_x, and R_x is then extracted based on the finite element analysis (FEA) modeling. The simulation results show that the resonator achieves a high quality factor of 750,000 with a small equivalent impedance of 82.5Ω comparing to the former researches. It is the fact that the designed resonator attains the optimization of a designed scheme. This research also helps us to point the resonator equivalent parameters out before packaging, which saves a lot of time and production cost.

Keywords. Quality factor, MEMS resonator, Face-shear mode, Finite element analysis, Sillicon-on-insulator.

ICATSD2A.440

DROP TEST OF MAGNETORHEOLOGICAL AIRCRAFT LANDING GEAR SYSTEM

BYUNG-HYUK KANG[1], SEUNG-BOK CHOI [2, 3*]

[1]*Inha University, Incheon 22212, Korea,*

[2]*The State University of New York, Korea (SUNY Korea), Incheon 21985, Korea,*

[3]*Department of Mechanical Engineering, Industrial University of Ho Chi Minh City, Vietnam;*

1357op@gmail.com, seungbok.choi@sunykorea.ac.kr

Abstract. A magnetorheological fluid-based aircraft landing gear system is designed, and its performance is evaluated via a drop test emulating the landing motion. The designed landing gear system is suitable for 1,360 kg class light aircraft. The jounce-rebound damping characteristics are set differently considering the landing characteristics. The shock strut efficiency which is frequently adopted as a drop performance index is evaluated through the stroke-ground reaction curve at various sink speeds and input currents. Lastly, the proposed landing gear model is verified by comparing the simulated and tested results.

Keywords. Magnetorheological fluid (MR fluid), MR damper, aircraft landing gear system, shock strut efficiency.


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