University of
Engineering and Technology

Institue of Mechanics

Program and Abstracts of the 3rd International Conference on Engineering Mechanics and Automation - ICEMA3

The 10th Anniversary of the University of Engineering and Technology,

Vietnam National University, Hanoi

Hanoi, October 15, 2014

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Conference Information

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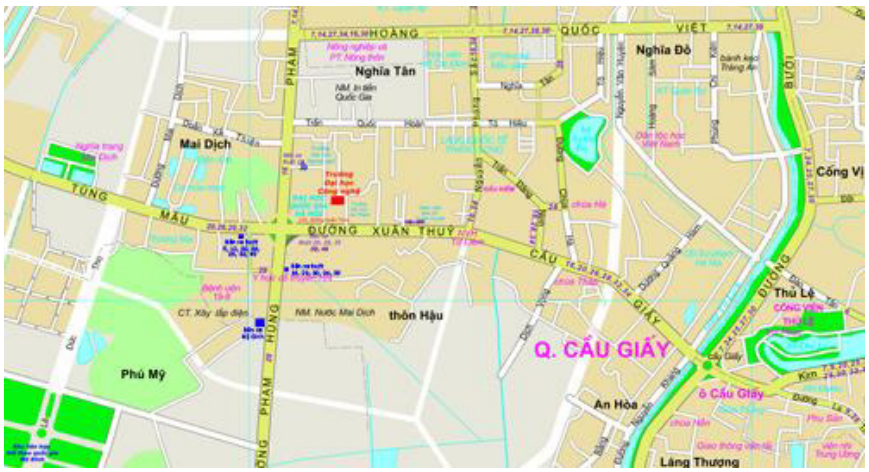

Direction to the University of Engineering and Technology

144 Xuan Thuy Street, Cau Giay, Hanoi, Vietnam

PROGRAM

Program at a Glance

October15, 2014

Giờ-Time	**Auditorium G3**				
7:30-8:30	Registration				
8:30-9:00	**Opening Ceremony**				
	Keynote Speakers *Chaimen: Prof. Nguyen Dong Anh, Prof. Pham Manh Thang*				
9:10-9:30	*Nguyen Dong Anh.* Dual approach to mechanical problems				
9:30-10:00	*Nguyen Dinh Duc.* Mechanics of three phase nanocomposite materials and structures				
10:00-10:15	***Tea Break***				
	Parallel Sessions				
Room	1	2	3	4	5
10:15-12:00 Chairmen	**Mechatronics and Machinery** *Assoc. Prof. Pham Manh Thang* *Dr. Seung Chul Jung*	**Fluid Mechanics** *Prof. Duong Ngoc Hai* *Assoc. Prof. Nguyen Thi Viet Lien*	**Solid Mechanics** *Prof. Dao Huy Bich* *Assoc. Prof. Dao Van Dung*	**Solid Mechanics** *Assoc. Prof. Nguyen Xuan Hung* *Assoc. Prof. Phan Dinh Huan*	**Dynamics and Control** *Prof. Nguyen Van Khang* *Dr. La Duc Viet*
12:00-13:30	***Lunch Time***				
13:30-15:15 Chairmen	**Mechatronics and Machinery** *Assoc. Prof. Pham Manh Thang* *Assoc. Prof. Chu Duc Trinh*	**Fluid Mechanics** *Assoc. Prof. Dinh Van Manh* *Assoc. Prof. Dang The Ba*	**Solid Mechanics** *Prof. Nguyen Dinh Duc* *Assoc. Prof. Truong Tich Thien*	**Solid Mechanics** *Assoc. Prof. Dao Nhu Mai* *Dr. Vu Cong Hoa*	**Dynamics and Control** *Dr Nguyen Viet Khoa* *Dr. Nguyen Quang Hoang*
15:15-15:30	***Tea Break***				
15:30-17:00 Chairmen	**Mechatronics and Machinery** *Dr. Seung Chul Jung* *Dr. Do Tran Thang*	**Fluid Mechanics** *Prof. Vu Duy Quang* *Assoc. Prof. Bui Dinh Tri*	**Solid Mechanics** *Prof. Tran Ich Thinh* *Assoc. Prof. Tran Minh Tu*	**Solid Mechanics** *Assoc. Prof. Nguyen Dac Trung* *Dr. Nguyen Xuan Thanh*	**Solid Mechanics** *Prof. Vu Dinh Loi* *Dr. Nguyen Viet Khoa*

Program in Details

07:30-08:30 ***Registration***

Opening Ceremony – Room 3-G3 Building

08:30-08:40 Opening speech of the Rector of the University of Engineering and Technology

08:40-08:45 Welcome speech of the Director of the Institute of Mechanics

08:45-08:50 Welcome speech of the Representative of the R&D Centre of Samsung Group

08:50-08:55 Welcome speech of the Director of the Asia Research Center

08:55-09:00 An overview report of the Head of Organizing Committee

Keynote speakers – Room 3-G3 Building

Chairmen: Prof. Nguyen Dong Anh, Assoc. Prof. Pham Manh Thang

09:00-09:30 *Nguyen Dong Anh.* Dual approach to mechanical problems

09:30-10:00 *Nguyen Dinh Duc.* Mechanics of three phase nanocomposite materials and structures

10:00-10:15 Tea Break

1. Mechatronics and Machinery – Room 1

Chairmen: Assoc. Prof. Pham Manh Thang and Dr. Seung Chul Jung

10:15-10:30 *Bui Trong Hieu and Phung Thanh Huy.* Design and Fabrication of Precise Shoe-upper Feeder System for Screen Printing Machine in Shoe Industry

10:30-10:45 *Cao Anh Khoa, Nguyen Tuong Anh, Ho Thi Thu Hong, Nguyen Quy, Vu Cong Hoa and Nguyen Tuong Long.* Building Module Calculation Power Coefficient of Vertical Axis Wind Turbine

10:45-11:00 *Duy-Khoe Dinh, Duc-Toan Nguyen and Hong-Minh Thi Nguyen.* FEM Simulation to Optimize Technological Parameters of Inside Gate Cutting of the Back Cover of Mobile Phone

11:00-11:15 *Do Duc Trung, Ngo Cuong and Phan Bui Khoi.* A Study on Kinematics of Workpiece in Plunge Centerless Grinding Process

11:15-11:30 *Ngo Van Quyet.* Research Crack Propagation at Tooth of Gear in the Gearbox of Near-Shore Horizontal Axis Wind Turbine

11:30-11:45 *Nguyen Van Duong, Bui Manh Cuong and Ta Dinh Xuan.* Study on the Mechanical Principle of Residual Stress Relieving in Workpiece by Vibratory Force

11:45-12:00 *Nguyen Thi Thu, Nguyen Dac Trung, Dinh Van Duy and Le Trung Kien.* Research on the hydrostatic forming to produce complex sheet details in cars

12:00-13:30 Lunch Time

Chairmen: Assoc. Prof. Pham Manh Thang and Assoc. Prof. Chu Duc Trinh

13:30-13:45 *Pham Quoc Thai, Chihiro Nakagawa, Atsuhiko Shintani and Tomohiro Ito.* The Effects of a Driving Assistance System on Multiple Personal Mobility Vehicles

13:45-14:00 *Tung Bui Duc, Nam Pham Hoai, Hang Bui Thu and Trinh Chu Duc.* Effect of the focused surface acoustic wave devices on the microfluidic channel

14:00-14:15 *Huynh Le Phuoc Son, Pham Minh Thanh, Ngo Thanh Minh Quoc and Nguyen Tuong Long.* Lightweight Scissor Lift System improvements Using Simulation Technology

14:15-14:30 *Nguyen Dac Hai, Pham Hoai Nam, Vu Quoc Tuan, Tran Thi Thuy Ha, Nguyen Ngoc Minh, Chu Duc Trinh.* Air bubbles detection and alarm in the bloodstream of dialysis using capacitive sensors

14:30-14:45 *Nguyen Thi Hong Hanh, Nguyen Nhu Hieu and Do Tran Thang.* An adaptive tracking control law for wheeled mobile robots with uncertain parameters

14:45-15:00 *Minh Triet Nguyen, Manh Thang Pham and Dong Anh Nguyen.* Design wireless control system for aircraft model

15:00-15:15 *Thai Son Tran, Manh Thang Pham and Viet Ha Nguyen.* Improve the efficiency of data encryption in wireless transmission

15:10-15:30 Tea Break

Chairmen: Dr. Seung Chul Jung *and Dr. Do Tran Thang*

15:30-15:45 *Phan Boi Chau, Le Hoang Gia Nhat, Le Hoang Hai, Nguyen Thi Huynh Lan, Tran Minh Thai, Mai Huu Xuan, Tran Anh Tu and Nguyen Tuong Long.* Solution of Optical System Control for Cutting Corneal Mechanism in Treatment for Myopia by Piezo Technology

15:45-16:00 *Tran Quang-Huy and Tran Duc-Tan.* Improvement in the Measurement Configuration for Ultrasound Tomography

16:00-16:15 *Vu Le Huy and Shoji Kamiya.* A Parallel Experimental Setup for Tensile Tests of Silicon Thin Films in MEMS

16:15-16:30 *Vu Le Huy and Shoji Kamiya.* Evaluation of Fatigue Behavior of Arbitrarily-Shaped Polysilicon Thin Films under Cyclic Tensile Loading with Gradually Increasing Amplitude

2. Fluid Mechanics – Room 2

Session 2.1. Modelling, Simulation and Analysis

Chairman: Prof. Duong Ngoc Hai and Assoc. Prof. Nguyen Thi Viet Lien

10:15-10:30 *Duong Ngoc Hai , Nguyen Tat Thang , Nguyen Quang Thai , Truong Thi Phuong , Luu Vu Phuong Thao, Le Minh Thanh and Nguyen Trong Tuan.* Simulation of supercavitating flow around a high speed moving object in water using Ansys Fluent

10:30-10:45 *Ha Tien Vinh.* Design Fan Wings by CFD Software – ANSYS Fluent

10:45-11:00 *Nguyen Hong Phong, Tran Thu Ha, F.X. Ledimet and Duong Ngoc Hai.* A wind-driven hydrodynamic and pollutant transport model with application of HLL and Riemann Solver schema.

11:10-11:15 *Nguyen Chinh Kien, Dinh Van Manh and Hoang Van Lai.* Evaluation of salinity instrusion in the Southwest coastal zone of Vietnam

11:15-11:30 *Tran Thu Ha, Nguyen Anh Son and Tran Van Thang.* 3D model of air projectile trajectories

11:30-11:45 *Tran The Hung and Dang Ngoc Thanh.* Effects of leading-edge figure on Aerodynamic Characteristics of 65° Delta wing

11:45-12:00 *Vu Ba Minh, Nguyen Quy, Bui Ta Long, Nguyen Thi Lan Anh and Nguyen Tuong Long.* Calculation and Simulation of Wood Dust Separation and Pollution Spreading in Air of Cyclone System

12:00-13:30 Lunch Time

Session 2.2. Industrial Fluid Mechanics and Environment

Chairman: Assoc. Prof. Dinh Van Manh and Assoc. Prof. Dang The Ba

13:30-13:45 *Dang The Ba and Thang Van Dat.* Application of Fuzzy Logic to Evaluate the Effect Between Inject and Production Wells in Naturally Fractured Reservoir of Vietnam

13:45-14:00 *Tran Anh Dung, Nguyen Dinh Huy and Bui Ta Long.* Model of mathematical and computation to evaluate the influence of surface lining to the extent and scope of the pollution in the atmosphere.

14:00-14:15 *Nguyen Hoang Quan and Le Van Phu.* Simple Radiative Model for Modeling Coupled Heat Transfer in Semi-Transparent Materials

14:15-14:30 *Nguyen Anh Son, Tran Thu Ha and Nguyen Xuan Luong.* Underwater super cavity model of slender body's motion.

14:30-14:45 *Nguyen Anh Son, Tran Thu Ha and Nguyen Van Tung.* 3 DOF underwater super cavity model of slender body's motion.

14:45-15:00 *Phan Hoang Nam.* Nonlinear hydrodynamic pressure on sloping dams and large radial floodgates during earthquakes

15:00-15:15 *Phan Hoang Nam and Nguyen Van My.* Influence of Upper Rivulet on Aerodynamic Characteristics of Stay Cable under Rain-Wind-Induced Vibration

15:15-15:30 Tea Break

Session 2.3. Applied Fluid Mechanics

Chairman: Prof. Vu Duy Quang and Assoc. Prof. Bui Dinh Tri

15:30-15:45 *Dang The Ba .* Simulation Model of a Direct Driven Heaving-Buoy Wave-Energy Converter

15:45-16:00 *Khuong Minh Tuan, Ngo Van Hien and Vu Duy Quang.* An Implementation Model to Deploy Planar Trajectory-Tracking Controllers for AUVs

16:00-16:15 *Cuong T. Nguyen, Ha H. Bui and Ryoichi Fukagawa.* Experimental study of the two-dimensional granular column collapse

16:15-16:30 *Nguyen Vo Thong, Nguyen Duc Viet and Tran Hung.* Study to select the fire protection methods for steel structures in Vietnam conditions

16:30-16:45 *Nguyen Vo Thong, Nguyen Duc Viet and Tran Hung.* Study of the parameters influencing the thermal conductivity of gypsum plasterboard under fire action in Vietnam conditions

16:45-17:00 *Pham Xuan Tung, Pham Gia Diem, Vu Quoc Huy and Ngo Van Hien.* A Capsule-Based Model to Implement Controllers for Quadrotor UAVs

3. Solid Mechanics

Room 3

3.1 Composite Material 1

Chairman: Prof. Dao Huy Bich and Assoc. Prof. Dao Van Dung

10:15-10:30 *Dao Van Dung, Dao Huy Bich and Vu Hoai Nam.* Nonlinear dynamic buckling analysis of axially loaded stiffened toroidal shell segments with FGM coatings surrounded by an elastic medium

10:30-10:45 *Dao Van Dung, Le Kha Hoa and Bui Thi Thuyet.* Buckling Analysis of Eccentrically Stiffened FGM-Core Layer-FGM Truncated Conical Shells Resting on Elastic Foundations

10:45-11:00 *Le Kha Hoa and Dao Van Dung.* On the Nonlinear Stability of ES-FGM Circular Cylindrical Shells under External Pressure on Elastic Foundation

11:00-11:15 *Vu Hoai Nam and Dao Van Dung.* Nonlinear Dynamic Buckling of Functionally Graded Cylindrical Shells with Different Eccentrically Stiffener Forms under Axial Compression and External Pressure

11:15-11:30 *Nguyen Thi Phuong.* Nonlinear static and dynamic buckling of eccentrically stiffened doubly curves shallow shells with functionally graded coatings resting on elastic foundation subjected to mechanical loads

11:30-11:45 *Nguyen Dinh Duc, Pobedrya B.E., Dao Huy Bich and Pham Toan Thang*. Nonlinear analysis on flutter of S-FGM thin circular cylindrical shells with metal-ceramic-metal layers surrounded on elastic foundations using Ilyushin supersonic aerodynamic theory

11:45-12:00 *Vu Thi Thuy Anh, Dao Huy Bich and Nguyen Dinh Duc.* Nonlinear Post-Buckling Analysis Of Thin Sigmoid FGM Annular Spherical Shells Surrounded On Elastic Foundations Under Uniform External Pressure Including Temperature Effects

12:00-13:30 Lunch Time

3.2 Composite Material 2

Chairman: Prof. Nguyen Dinh Duc and Assoc. Prof. Truong Tich Thien

13:30-13:45 *Vu Van Dung, Vu Thi Thuy Anh and Nguyen Dinh Duc.* Nonlinear response of axisymmetric shear deformable FGM shallow spherical shells resting on elastic foundations under external pressure

13:45-14:00 *Dao Van Dung, Le Kha Hoa and Tran Thi Thom* Buckling Analysis of Eccentrically Stiffened Functionally Graded Plates Resting on Elastic Foundations Based on First-Order Shear Deformation Theory

14:00-14:15 *Nguyen Thi Phuong, Dao Huy Bich.* Research on stability of parallel eccentrically stiffened annular spherical segments with functionally graded coatings under mechanic loads

14:15-14:30 *Tran Quoc Quan and Nguyen Dinh Duc.* Nonlinear Dynamic and Vibration of Imperfect Sigmoid-Functionally Graded Double Curved Shallow Shells Resting on Elastic Foundation using the First Order Shear Deformation Theory

14:30-14:45 *Nguyen Dinh Duc, Pham Hong Cong and Song Jung-Il.* Nonlinear vibration of thick Sigmoid-FGM plates on elastic foundation subjected to thermal load using the third order shear deformation theory

14:45-15:00 *Pham Van Thu, Tran Quoc Quan, Homayoun Hadavinia, Nguyen Dinh Duc.* Nonlinear dynamic analysis and vibration of imperfect three phase polymer nano-composite panel resting on elastic foundation under hydrodynamic loads

15:00-15:15 *Tran Minh Tu, Dang Xuan Hung and Nghiem Ha Tan.* Analytical solution for axisymmetric bending of radially functionally graded circular plates

15:10-15:30 Tea Break

3.3 Composite Material 3

Chairman: Prof. Tran Ich Thinh and Assoc. Prof. Tran Minh Tú

15:30-15:45 *Tran Minh Tu, Tran Huu Quoc, Dang Xuan Hung.* Analytical solutions for bending response and free vibration analysis of exponentially graded rectangular plates

15:45-16:00 *Tran Huu Quoc, Tran Minh Tu and Nguyen Van Long.* Free vibration analysis of Reissner – Mindlin functionally graded plates by finite element method

16:00-16:15 *Tran Ich Thinh, Nguyen Van Trang and Nguyen Manh Cuong.* Free vibration of fluid-filled laminated composite cylindrical shells on elastic foundations

16:15-16:30 *Tran Minh Tu and Duong Thanh Huan.* Vibration analysis of exponentially graded plates using various shear defomation plate theories

16:30-16:45 *Trinh Anh Tuan, Tran Huu Quoc and Tran Minh Tu.* Static analysis of stiffened laminated composite cylindrical shell using finite element method

16:45-17:00 *Nguyen Manh Cuong, Tran Ich Thinh and Vu Quoc Hien.* Vibration analysis of thick laminated composite joined conical-cylindrical shells by Continuous element method

Room 4

3.4 Composite Material 4

Chairman: Assoc. Prof. Nguyen Xuan Hung and Assoc. Prof. Phan Dinh Huan

10:15-10:30 *Phan Thi Dang Thu, Phan Dinh Huan and Nguyen Thanh Truong.* Effect parametric to properties of a 2D orthogonal plain classical woven fabric composite

10:30-10:45 *Kim Bang Tran, Thanh Nha Nguyen, Thai Hien Nguyen, Huu Dien Nguyen, Quoc Tinh Bui and Tich Thien Truong.* Extended finite-element method for modeling circular and elliptical hole in functionally graded material plate

10:45-11:00 *H. Nguyen-Xuan, Chien H. Thai.* A unified computational framework for theory, modeling and analysis of multilayered plate/shell structures

11:00-11:15 *Le Thi Bich Nam, Nguyen Manh Cuong and Tran Ich Thinh.* Continuous Element formulation for thick composite annular plates and rings resting on elastic foundation

11:15-11:30 *Lieu B. Nguyen, Chien H. Thai, Son H. Nguyen and H. Nguyen-Xuan.* Isogeometric analysis of laminated composite plates using a new unconstrained theory

11:30-11:45 *Tran Ich Thinh, Nguyen Manh Cuong, Ta Thi Hien and Vu Quoc Hien.* Vibration of a composite truncated conical shell filled with fluid

11:45-12:00 *Tran Ich Thinh, Ta Thi Hien and Nguyen Manh Cuong.* Numerical-Experimental studies on free vibration of laminated glass fiber/polyester truncated conical shells containing fluid

12:00-13:30 Lunch Time

3.5 Solid Mechanics – Fundamental Problems

Chairman: Assoc. Prof. Dao Nhu Mai and Dr. Vu Cong Hoa

13:30-13:45 *Nguyen Khoi Nguyen and Truong Tich Thien.* Yield Surface of Porous Ductile Material Containing Spherical Voids

13:45-14:00 *Nguyen Huu Hao, Nguyen Ngoc Trung and Vu Cong Hoa.* Ductile Fracture Analysis of API X65 Steel by Modified Gurson Model in ABAQUS

14:00-14:15 *Truong Thi Thuy Dung, Nguyen Thi Mai and Tran Thanh Tuan.* Dispersion equation of Rayleigh surface waves in stratified layer by ray and R/T theories

14:15-14:30 *Tran Thanh Tuan, Truong Thi Thuy Dung, Nguyen Thi Thu and Tran Ngoc Trung.* Amplification of the surface layer to the body waves

14:30-14:45 *Luong Quoc Viet and Nguyen Thanh Truong.* Stability Analysis of Two – Dimensional Trusses

14:45-15:00 *Pham Huu Thang, Nguyen Tuan Hung, Vuong Van Thanh and Do Van Truong.* Multiscale analysis of the stress singularity order of Pb(ZrxTiy)O3/Si bi-material.

15:00-15:15 *Vuong Van Thanh, Nguyen Tuan Hung, Pham Huu Thang and Do Van Truong.* Interface structure and mechanics of Ag/Al multi-layers: an ab initio study

15:10-15:30 Tea Break

3.6 Solid Mechanics in Structural Engineering 1

Chairman: Assoc. Prof. Nguyen Dac Trung and Dr Nguyen Xuan Thanh

15:30-15:45 *Cao Nhan Tien, Tran Thai Duong, Ngo Thanh Minh Quoc, Nguyen Thi Huynh Lan, Vu Cong Hoa and Nguyen Tuong Long.* Building and Applying a Computer Simulation Program to optimize the Structure of motorcycle helmet under impact

15:45-16:00 *Le Trung Kien and Nguyen Dac Trung.* Investigation thinning in sheets hydroforming static via experimental and finite element simulation

16:00-16:15 *Nguyen Huy Cuong and Ngo Dang Quang.* Numerical Analysis of Reinforced Concrete Beams Strengthened with Textile Reinforced Concrete

16:15-16:30 *Thanh Xuan Nguyen, Anh Hoang Pham and Hadi Razavi.* Numerical Aspects of a Time Integration Scheme for Dynamic Analysis of Structures

16:30-16:45 *Ta Hong Phong, Do Quan Tung.* The method of Calculation on Fatigue Failure at welding joint in the conveyor screw carrying bulk materials rely with view of point on Fracture Mechanics

16:45-17:00 *Anh Hoang Pham, Thanh Xuan Nguyen and Hung Van Nguyen.* Fuzzy structural analysis using improved differential evolutionary optimization

Room 5

3.7 Solid Mechanics in Structural Engineering 2

Chairman: Prof. Vu Dinh Loi and Dr. Nguyen Viet Khoa

15:30-15:45 *Khoa Viet Nguyen, Quang Van Nguyen and Mai Van Cao.* Flutter analysis of a high slender damaged structure

15:45-16:00 *Le Thi Viet Anh, Dao Nhu Mai and Dang Ba Duy.* Dynamic Response of Structures under Random Wave Loading using Constrained Tromans Wave.

16:00-16:15 *Dao Nhu Mai, Dang Van Ky, Le Thi Viet Anh and Nguyen Cong Tuyen.* Dynamic Response of Slender Structures under Random Wind Loading accounting the turbulence.

16:15-16:30 *Vu Dinh Loi, To Duc Tho, Le Anh Tuan and Nguyen Cong Nghi.* Experimental study of determining reflected waves on the underwater structures

16:30-16:45 *Nguyen Huu The, Vu Dinh Loi, Le Anh Tuan, Nguyen Cong Nghi.* Building the experimental formula defining blast wave parameters in coral medium

16:45-17:00 *Nguyen Huu The and Vu Dinh Loi.* Study on the propagation of blast wave in coral medium and interaction with the works having soft structure

4. Dynamic and Control – Room 5

Session 4.1. Vibration and Control

Chairman: Prof. Nguyen Van Khang and Dr. La Duc Viet

10:15-10:30 *La Duc Viet.* Vibration control of a beam using on off damping

10:30-10:45 *N.D. Anh, V.L. Zakovorotny, D.N. Hao, N.C. Thang.* Probabilistic behaviors of Mathieu-Duffing oscillator under external periodic and random excitations

10:45-11:00 *Nguyen Thai Minh Tuan and Nguyen Van Khang.* Calculating periodic and chaotic solutions of piecewise-linear systems using matrix exponential

11:00-11:15 *Nguyen Trong Du and Nguyen Phong Dien.* Gear Fault Identification using Artificial Neural Network and Wavelet Packet Transform

11:15-11:30 *Nguyen Tien Dzung and Do Duc Nam.* Dynamics and position control of Teleoperation – Mobile robot

11:30-11:45 *Nguyen Quang Hoang and Nguyen Van Quyen.* Modeling and simulation of translational single flexible manipulator

11:45-12:00 *Van-Nhu Tran, Duc-Lich Luu and Van-Bang Nguyen.* Sliding Mode Control of a Continuously Variable Transmission During Shifting

12:00-13:30 Lunch Time

Session 4.2. Dynamics and Control of Structures

Chairman: Dr. Nguyen Quang Hoang and Dr. Nguyen Viet Khoa

13:30-13:45 *Nguyen Thi Cam Lai, Tran Thanh Hai and Nguyen Tien Khiem.* An approximation to the characteristic equation of multiple cracked beam

13:45-14:00 *Van My Nguyen.* Improvement of Flutter Instability in Long-Span Cable-Supported Bridge by Investigating the Optimum Box Section Geometry

14:00-14:15 *Nguyen Quang Hoang, Le Huu Minh and Vu Van Khoa.* Energy-based Controller with Optimization Tuning by Using Genetic Algorithm for Overhead Cranes

14:15-14:30 *Khoa Viet Nguyen, Oluremi A Olatunbosun and Tuan-Anh Bui.* Simultaneous influences of surface irregular parameters and moving speed on dynamic response of a double beam subjected to moving vehicle

14:30-14:45 *Khoa Viet Nguyen and Hai Thanh Tran.* Dynamic analysis of a double cracked beam with an attached mass-spring-damper system subjected to earthquake excitation

14:45-15:00 *Nguyen Nhu Hieu, Mai Phu Son, Nguyen Xuan Thanh and Bui Duc Tiep.* Phononic band gap characteristics of wave propagation in a two-dimensional brick wall-like periodic square lattice structure

15:00-15:15 *Vu Kim Long, Nguyen Thai Minh Tuan and Nguyen Quang Hoang.* Optimal Control for Variable Stiffness System by Using Bang-Bang Technique

15:10-15:30 Tea Break

PLENARY SESSION

Dual approach to mechanical problems

Nguyen Dong Anh

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Abstract

Natural phenomena and human activities exhibit often dual characters which reflect two side processes or/and the relative balance of two opposite sides. For illustration we may say attack – defense in a football match, one way and return in an excursion, day and night. When a problem is considered it is quite often that one its side is given too much attention while other its side is almost or completely forgotten. This usual approach doest not reflect, in many cases, the real essence of the problem in question and hence doest not yield an expected solution. The main aim of the presentation is to recommend the significant use of the dual approach to the study of mechanical problems. The dual conception is first outlined based on some practical engineering examples. Further, a detailed analysis and numerical simulations are given in the following topics: vector projection, equivalent linearization method, design of TMD for damped systems, Duffing oscillator subjected to combined periodic and random excitations.

Mechanics of three phase nanocomposite materials and structures

Nguyen Dinh Duc

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144 - Xuan Thuy – Cau Giay – Hanoi – Vietnam

Composite materials are widely used in Vietnam now. To improve the physical and mechanical characteristics of composites structures, polymer- matrix are usually reinforced by fibers and nano-particles. The report is collection of the latest works of author, focusing mostly on the determining the elastic modulus, thermal expansion coefficients, the creeps of the three phase composites nDm and their the strength with adhesive failure. The report also presents manufacturing technology of the three phase polymer composites in laboratory.

Based on obtained results, the report investigated the bending and the creep of the three phase composite plates. Suitable volume ratios of particles, fibers and their orientations of three phase composite plate under thermo- mechanical loads is proposed and discussed.

This report also presents an analytical investigations on the nonlinear static and dynamic response of the imperfect laminated three phase polymer composite plates subjected to some mechanical and thermal loads. The formulations are based on the classical plate theory taking into account the interaction between the matrix and the particles, geometrical nonlinearity, initial geometrical imperfection of the plates and volume ratio of fibers and particles in the composite structures. Effects of the fibers and the particles, material and geometrical properties on the buckling and post buckling loading capacity, dynamic response of the three phase polymer composite plates are analyzed and discussed.

MECHATRONICS AND MACHINERY

Design and Fabrication of Precise Shoe-upper Feeder System for Screen Printing Machine in Shoe Industry

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Abstracts

In this paper, a precise position control of shoe-upper for six stations screen printing machine using image processing techniques is introduced. A camera is used to capture the image of shoe-upper. The boundary of shoe-upper is used as the sensing points for the image processing to recognize the position errors in directions of X, Y and θ coordinates. A new algorithm to calculate the position errors of shoe-upper is proposed. The shoe-upper is locating on $X-Y-\theta$ tables which can move X, Y directions and rotating θ angle. These tables are controlled by three servo motors. The duty of $X-Y-\theta$ tables is adjusted the shoe-upper to right position by comparing to standard position which saved in camera before. The shoes-upper that adjusted correct position will be moved to the conveyor of the screen printing machine by ball screw system. The effectiveness of the precise shoe-upper feeder system is proven through experimental results.

Key Words: Shoe-upper, Press-segment, Image processing, $X-Y-\theta$ tables.

Effect of the focused surface acoustic wave devices on the microfluidic channel

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Abstract

This paper presents an effect of the focused surface acoustic wave (F-SAW) sensors on the microfluidic channel. The investigated structures here use Aluminum Nitride (AlN) substrate as CMOS material. As the organization mechanism of the F-SAW sensors is based on the mechanical vibration such asthe total displacement and the pressure, it is necessary to study the influence on the channel. The F-SAW devicesare composed of focusedinterdigital transducers (F-IDTs) such as fingers with arcs (D_a= 90^0) of concentric circles, multiple-segment fingers, different straight fingers. The microfluidic channel as the nozzle orifice is etched through wafer at the middle of the focal line and is perpendicular to the SAW propagation path between the

transmitter and receiver IDT. The influence of the F-SAW on the channel is insignificant and energy is mostly concentrated on the central arc of the channel.

Keywords— Focused surface acoustic wave sensor

Building Module Calculation Power Coefficient of Vertical Axis Wind Turbine

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Abstract

The purpose of this paper to propose design parameters, for maximum power coefficient of a 1kW straight bladed vertical axis wind turbine, to serve energy needs for families in Vietnam. In the process of modeling vertical axis wind turbine under the influence of natural wind flow, multiple stream tube theory of Habtamu Beri, Yingxue Yao be used, with supporting tools of MATLAB software. Module calculation power coefficient of vertical axis wind turbine is set. Thence, draw graph of the relationship between power coefficient, tip speed ratio, solidity with wing profile and wind speed range of 3-10m/s.

Key words: multiple stream tube theory, power coefficient, vertical axis wind turbine, tip speed ratio, solidity, wing profile.

FEM Simulation to Optimize Technological Parameters of Inside Gate Cutting of the Back Cover of Mobile Phone

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Abstract

In current study, in order to minimize deflections occurred outside of the back cover after cutting the gate which was remaining in the injection molding process, parameters of cutting tool such as rake angle, clearance angle and cutting velocity were considered according to Taguchi's orthogonal array and coupled with the ductile fracture criterion of the finite element method (FEM). First, the data from the test of stress-strain and Johnson-Cook damage model

were input into ABAQUS/Explicit finite element code to predict the phenomenon occurrence after cutting process. Three parameters variable - the rake angle, clearance angle and cutting velocity were then selected to establish their effects on the outside deflection of the back cover. The analysis of variance (ANOVA) on the collected data from the Taguchi's orthogonal array revealed that the clearance angle made the highest influence on the outside deflection and the contribution percentage of the cutting velocity was the smallest. The optimum simulation case was finally performed and confirmed by experiment

KEYWORDS:, FEM, Gate cutting, Ductile Fracture criterions, Taguchi's method, earring

A Study on Kinematics of Workpiece in Plunge Centerless Grinding Process

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Abstract

In the most studies on simulation of plunge centerless grinding process, the center of workpiece is usually considered to be fixed position in grinding process. This paper presents the research on kinematics of workpiece in plunge centerless grinding process with the aim of determining the workpiece centre displacement. In addition, this work also carries out an analysis of the relationship between workpiece centre displacement and grinding allowance as well as the geometric parameters of technological system; basing on that, the expression of workpiece centre displacement is given. The specification of centre displacement of the workpiece plays a crucial role in improving the accuracy of the performance on simulations of plunge centerless grinding.

Key Words: plunge centerless grinding, kinematics, work piece centre displacement, mathematical expression, simulation

Lightweight Scissor Lift System improvements Using Simulation Technology

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Abstract

This paper presents the solution of System for Mobile Scissor Lift to lift and move lightweight goods easily by using Simulation Technology. SOLIDWORKS and ANSYS are used for this research. The purpose of this research is to introduce new smart scissor lift design where its results are analyzed carefully to customer with cheaper price; this mechanisms system can work advantage within small space such as mini supermarkets and house. Finally, smartphone control

program BK-LM that is built by JAVA language on Android operating system is applied to help users control easily.

Key Words: Scissor Lift, Smartphone Android, ANSYS/ADAMS, Solidworks, BK-LM.

Research Crack Propagation at Tooth of Gear in the Gearbox of Onshore Horizontal Axis Wind Turbine

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Abstract

The main following contents of this article will be presented by author: Structure of Gearbox in the Horizontal Axis Wind Turbine (HAWT); functions of loads acting on the tooth; working of the gearbox; preparing crack systems; crack propagation equation at the tooth of the gear; method determination lifetime from Crack Propagation. At the end of article will be showed a concrete example to determine lifetime of Gearbox in the Onshore HAWT.

Key Words: Crack Propagation, Paris-Erdogan's Law, wind speed, Wind load, Onshore HAWT; Fracture Mechanics, Fatigue lifetime

Study on the Mechanical Principle of Residual Stress Relieving in Workpiece by Vibratory Force

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Abstract

This research follows a mechanical approach of stress relieving process in workpiece by vibratory force (vibratory stress relief) to build mathematical model and perform numerical simulation of residual stress relieving process in the workpiece under external cyclic force. The obtained results show a close view on the mechanical principles of the process and show the effect of technological parameters such as frequency, amplitude…on the relaxation of residual stress. These results can serve as recommendations for the technological process and for the design and manufacture of vibratory stress relief equipment.

Keywords: residual stress, vibratory stress relief.

Air bubbles detection and alarm in the bloodstream of dialysis using capacitive sensors

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Abstract

This paper introduces design and fabrication of a fluidic capacitive sensor used to detect the presence of air bubbles in the blood stream of dialysis. The unwanted case of occurring air bubble inside the blood stream for dialysis can be controlled and monitored. Capacitive sensors are structured by electrodes on printed circuit board (PCB) and vertical side clamp the pipe of blood stream made a complete sensor for detection air bubble. The size and speed of air bubbles, which may lead patient to dead, are monitored and controlled by observing the output signal change of the capacitor. When air bubbles appear in the pipe of blood, capacitive sensors will be changed the capacitance, the valuesobtained from the output voltage are calculated to monitor the presence of air bubbles and estimates its velocity. Then the sensor will help to give an alarm to the dialysis system for saving patient.

Key Words: Capacitive sensor, air bubble detection

An adaptive tracking control law for wheeled mobile robots with uncertain parameters

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Abstract

In this study, an adaptive control law for wheeled mobile robots tracking a reference trajectory is proposed. The control rules are performed with the use of a technique of backstepping for the dynamic model of the mobile robot containing uncertain parameters. The numerical simulation results for the controller are carried out for several types of trajectory. It is shown that the proposed controller yields results of asymptotic convergence of the tracking errors.

Research on the hydrostatic forming to produce complex sheet details in cars

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Abstract

In the automobile manufacturing industry, most of sheet details in the body of cars are complex. Moreover, the precise and quality of their shape, geometry and durability have to be warranted during manufacturing. Therefore, it is difficult to deform them by common methods, such as forming with solid punch and die or with rubber punch or with rubber die. One of the most advance methods, which drew the interest of researchers recently and was applied to produce the complex sheet parts, is the hydrostatic forming. By using the high pressure of liquid, hydrostatic forming makes the part deform easier and increase the quality of its surface. However, in Vietnam, this method is still new, so it haven't been applied widely yet. The authors built the model for center pillar – a part to link two doors in a car - and researched the influence of parameters of hydrostatic forming on the quality of this detail. This paper shows the simulation result of this research with Dyna Form software.

Design wireless control system for aircraft model

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Abstract

This paper is concerned with the research and design wireless system to control and exchange data between aircraft model and base station. The motherboard of control system is designed with 8-bit AVR microcontroller from Atmel corporation. For design the hardware of wireless module, the electronic component NRF24L01 of Nordic Semiconductor has been selected as the core of the RF receiver / transmitter with frequency 2.4 Ghz. The NRF24L01 is a modern component, low-cost, low power and it was designed specifically for wireless applications. The circuit techniques, development of embedded software for wireless communications are focused in this report. This idea has been being realized in the Faculty of Mechanics and Automation (FEMA), University of Engineering and Technology, Vietnam National University in Hanoi.

Key words: Microcontrollers, Aircraft, Wireless, RF transmitter, Global Positioning System (GPS)

The Effects of a Driving Assistance System on Multiple Personal Mobility Vehicles

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Abstract

In recent years, new mobility vehicles for individual usage called personal mobility vehicles (PMVs) are expected to develop in terms of protection of the environment, convenience for personal short-distance trips, support for an aging society, and ensuring the right to mobility. However, it is necessary to consider the safety and comfort of both pedestrians and PMVs when PMVs share the space with pedestrians. In this study, we proposed a driving assistance system for PMVs typed two-wheel dynamically stabilized vehicles, and analyzed the influence of PMVs equipped with the assistance system on surrounding pedestrians based on the personal space that is the space invaded by others causing a psychological strain. In order to evaluate the mutual effects of PMVs and pedestrians, the invasion ratio and the crossing time were proposed. From the simulation results, it was found that the effectiveness of the assistance system was clearly confirmed. When PMVs were equipped with the assistance system, the invasion ratio and the crossing time became smaller than those in the case of PMVs without the assistance system.

Key Words: Driving assistance system, pedestrians, personal mobility vehicles, personal space, simulation.

Solution of Optical System Control for Cutting corneal Mechanism in Treatment for Myopia by piezo Technology

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Abstract

The purpose of this article is to design a control optical system for cutting corneal mechanism in treatment for myopia, with micro size. Research has concentrated on propose a system and calculate displacement, frequencies of system, after that besed on photochemical phenomenon, such as: irradiated laser ray into the eyes of patients after created a corneal flap and abrasive phenomenon of cornea being studied. The laser ray followed navigation device and putted in equipments which controlled by piezo device. Results based on theory of couple field to find out

displacements and frequencies to ensure this system can be used in treatment for myopia. In the future, we want to create real system using piezo device to control cutting corneal mechanism.

Key Words: cutting corneal mechanism in treatment for myopia piezo technology, optical system, corneal abrasion phenomenon, laser ray.

Improvement in the Measurement Configuration for Ultrasound Tomography

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Abstract

Ultrasound Tomography is a very powerful tool for finding small tumors in women's breast for all ages, compared to the conventional mammography method which is just suitable for over-fifty-year women. The biggest limitation of ultrasound tomography for commercialization is its high computational complexity that depends mainly on two factors (the number of measurements and the total number of iterations needed for the successful image reconstruction). In general, there are many kinds of measurement configuration in tomography. In fact, it is a problem of how to place the transmitters and the receivers to obtain the best reconstruction quality. This paper focuses on setting up the most efficient measurement configuration with a moderate number of transducers. The measurement configuration is then combined with an inverse scattering technique named Distorted Born Iterative Method to reconstruct the image. The mechanical design and electronic modules are also provided for the completed system.

Improve the efficiency of data encryption in wireless transmission

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Abstract

Remote Keyless Entry (RKE) systems have been widely used in automobiles, automatic garage doors, smart home and other wireless authentication applications. Such systems are usually based on unidirectional transmission via RF or IR, using lightweight ciphers to protect communication data. Normally the encryption keys used in those ciphers are derived from a manufacturer's code using key generation algorithm. The manufacturer's code is supposed to be constant and to be shared among a set of products (e.g., an entire series or a certain model within one production year). This makes the manufacturer's code an appealing target for attackers. Therefore, care must be taken to implement the key generation algorithm in such a way that even if the attacker successfully broke a product's cipher and obtained a single encryption key, he could not easily deduce the manufacturer's code (the master key).

In this paper, we investigate the Keeloq block cipher, a popular proprietary algorithm which is used in numerous widespread passive entry and RKE systems. Specifically, we analyze KeeLoq key management and authentication protocols and demonstrate several vulnerabilities in its key generation algorithm. We also propose security-enhancing techniques for key generation to better protect the master key.

Key Words: wireless authentication, encryption keys, Keeloq

A Parallel Experimental Setup for Tensile Tests of Silicon Thin Films in MEMS

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Abstract

To estimate static strength and fatigue behaviors of silicon MEMS structures on the basis of statistical analysis, static and fatigue tests should be performed to obtain the experimental data. Statistical analyses require a large amount of data, and therefore the tests consume so much time, especially for the case of fatigue test. In order to increase the number of experimental data as well as save the time, this paper presents a parallel experimental setup improved from previous single experimental setup for tensile tests of silicon thin films in MEMS. This setup also helps to save the expense by using commonly some items. The results obtained from the fatigue tests with this experimental setup were compared to those obtained from single experimental setup by using statistical analysis. It suggested that the parallel experimental setup is acceptable.

Evaluation of Fatigue Behavior of Arbitrarily-Shaped Polysilicon Thin Films under Cyclic Tensile Loading with Gradually Increasing Amplitude

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Abstract

The fatigue crack extension process determining fatigue lifetime of silicon MEMS structures under cyclic loading with constant amplitude was estimated by the well-known Paris law with two unknown parameters. In this paper, it is extended to evaluate the fatigue behavior of polysilicon thin films with arbitrary shapes, which induce non-uniform stress distribution, operating under cyclic loading with gradually increasing stress amplitude. The extended theory is examined by the experimental data obtained from the fatigue tests with gradually increasing stress amplitude at different rates. The results show that the fatigue behavior of non-uniform stress distribution polysilicon thin films could be estimated by using the two unknown parameters of the Paris' law obtained from the conventional fatigue experiments with constant amplitude.

FLUID MECHANICS

Simulation Model of a Direct Driven Heaving-Buoy Wave-Energy Converter

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Abstract

Development of wave energy conversion devices are being desired more and more by general trends on the use of renewable energy to replace fossil fuels sources which are being depleted.

This report presents a simulation study for a slack-moored wave-energy converter using linear permanent magnet generator (WEC). This device consists of a semi-submerged heaving buoy moving relative to a submerged plate. Two bodies ware be connected by a linear generator that is a direct-driven conversion mechanism which utilizes the relative motion between the two bodies. The WEC can then be slack-moored, and the mooring is used to keep the WEC in the desired horizontal position.

Base on the physical model, a mathematical model is presented for a WEC, consisting of a floating buoy moving relative to a submerged plate, and the WEC is, in general, exposed to an irregular incident wave. From this model, a numerical model was built on the Matlab. The simulation results showed the depending of output power on some important parameters. This model also was used to calculate the parameters for optimal designs in difference scales.

Keywords: *modeling, numerical simulation, linear generator, permanent magnet, wave*

Application of Fuzzy Logic to Evaluate the Effect Between Inject and Production Wells in Naturally Fractured Reservoir of Vietnam

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Abstract

This paper shows the successful application of Artificial Intelligence tool such as fuzzy logic (FL) to evaluate the effect from inject wells to production wells base on well bottom-hole pressure that it had been measured in wells path in naturally fractured reservoir (NFR). The software had written primarily in the FORTRAN programming language. The program can associate with gnu plot to build 2D depth and correlation map.

This was achieved by first, collecting data from grid and wells history data file, and draw 2D depth map. Finally, fuzzy logic (FL) had been used to obtain the correlation between pressure of inject and production wells and ranking it. The program has been used to evaluate the degree of correlation between inject and production wells for Bachho basement reservoir.

Keywords: Fuzzy logic; Artificial intelligence, fractured reservoir; Bach Ho oilfield

Simulation of supercavitating flow around a high speed moving object in water using Ansys Fluent

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Abstract

Supercavitation phenomenon is the formation of a vapor cavity surrounding a high speed moving object in water. It is usually encountered in environment or in underwater applications in industry. Supercavitation can be very useful for reducing drag around the object. Therefore, the advantage of this phenomenon is highly desirable in designing high speed moving object in water. In order to characterize the effects of various relevant parameters (e.g. object's shape, flow conditions etc.), numerical modeling has been conducted to simulate supercavitating flow around a body in the water using Ansys Fluent. In addition, experimental observation of supercavitation has also been carried out. Experimental data has been initially correlated with numerical result. Preliminary results are reported.

Key Words: super-cavity, experiment, numerical modeling, Ansys Fluent

Design Fan Wings by CFD Software – ANSYS Fluent

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Abstract

Fan specially exhaust fan is very important in the real life. Exhaust fan was used in industrial factory, cooling system ... By the way, the capacity of fan sometime cannot be extend because of the measure of area in where we put the fan. So in this report, by using dimension of a subsonic wind tunnel, the maximum velocity is 50 m/s, the diameter of fan had been fixed in 0.6 meter, we will show some design of fan wing which will be simulated and calculated by CFD software ANSYS Fluent to find out better profile of fan wing which will be used in this wind tunnel.

Key Words: design fan wings, CFD, ANSYS Fluent, simulation

An Implementation Model to Deploy Planar Trajectory-Tracking Controllers for AUVs

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Abstract

A new model of control realization is developed to implement the planar trajectory planning and tracking control design for Autonomous Underwater Vehicles (AUVs). This model is mainly based on the Model Driven Architecture (MDA) in order to entirely cover the requirement analysis, design, implementation and deployment phases of systems, and can be applied to different AUV types. It also allows the designed elements to be customizable and re-usable in new applications of AUV control. The paper brings out step-by-step the AUV dynamic modeling of control, the specialization of MDA's features such as the Computation Independent Model (CIM) with use-cases and hybrid automata, the Platform Independent Model (PIM) carried out by using the Real-Time Unified Modeling Language (RT UML), as well as the Platform Specific Model (PSM) implemented by sub-system paradigms and object-oriented mechanisms to quickly perform the development lifecycle of planar trajectory-tracking controller for AUVs. Finally, this model was successfully applied to develop the horizontal trajectory-tracking controller of a miniature autonomous submerged vehicle.

Key Words: AUV control, underwater robots, object-oriented implementation, MDA, real-time UML, hybrid automata.

Experimental study of the two-dimensional granular column collapse

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Abstract

In this paper, a series of two-dimensional experiments of the granular column collapse were performed for the first time to investigate its failure mechanism. Herein, two-dimensional aluminum rods were utilized to represent soil model and Photron high speed camera (resolutions of 1024x512 pixels and 500 fps) was used to record the failure process of granular columns. Results were then compared with experiment data reported in the literature using quasi two-dimensional granular flow models. The paper found that the failure mechanisms of the granular column collapse under the truly two-dimensional condition are significantly different from those reported in the literature using the quasi two-dimensional soil models. If h_0 and d_0 are the initial height and the initial width of the column, h_∞ and d_∞ are the final height and the maximum run-out distance of the soil, then the data suggest that the ratios h_0/h_∞ and d_∞/d_0 are the power-function of $a = h_0/d_0$, that are $(d_\infty - d_0)/d_0 \approx 3.80a^{0.73}$, $h_0/h_\infty \approx 1.42\,a^{2/3}$ and $d_\infty/d_0 \approx 4.30\,a^{0.72}$. Furthermore, the first time, the influence of ground

surfaces (hard or soft beds) to the final run-out distance and failure zone of soil columns will be presented.

Evaluation of salinity intrusion in the Southwest coastal zone of Vietnam

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Abstract

The Southwest sea of Vietnam, from Ca Mau Cape to the Cambodian border, including Phu Quoc and Tho Chu islands, has been especially interested and played an important role in the socio-economic development and national security of Vietnam. Requirements for understanding natural conditions, especially hydrodynamical characteristics and the marine environment for construction, mining, protection and integrated management of this area is urgently needed.

In recent years, there have been several investigations and researches within the framework of national research projects to provide an overview of the understanding or to solve specific problems in the area. However, researches in details and concret, including complex changes of seabed topography, morphology shore, marine estuaries / channels were still not met the requirements.

In this report, a linked 1- 2D numerical model has been established to describe of the characteristics of tides, currents and evaluate of salinity intrusion through channel / river system of the southwest coastal region.

Key Words: 1-2D numerical model, salinity intrusion, tide, Southwest sea of Vietnam

A wind-driven hydrodynamic and pollutant transport model with application of HLL and Riemann Solver schema.

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Abstract

In this 2D model the HLL Riemann Solver schema is applied to approximate the water flows . The wind effects are considered in this model. The model is tested by 5 test cases and experimented by data of one natural lake in Hanoi.

The results of test cases with comparisons between exact, numerical solutions by the promotion approximation schema and by the normal differential implicit schema are showing the improvement of model's approximation.

Simple Radiative Model for Modeling Coupled Heat Transfer in Semi-Transparent Materials

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Abstract

The Radiative Transfer Equation (RTE) coupled with the heat transfer is often difficult to solve numerically. In this paper, we propose to solve this problem easily using a method based on a modified PN method approximating the RTE with a finite set of moment equations. After mathematical simplification, we show that Radiation can be modeled through a single second-order governing equation that exhibits the same form as heat transfer equation. Validation of this model with different 1D and 2D test cases (steady-state and transient regimes) is performed. Some results obtained for more difficult cases and more complex geometry as differentially heated cavity are then presented.

Key Words: PN method, Radiative Transfer Equation (RTE), Semi-Transparent Materials

Underwater super cavity model of slender body's motion.

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Abstract

In this model the super-cavity arising in underwater motion of slender body is studied using Ansys Fluent Solver Manager. The drag force acting to slender body and its velocity are written in sub-models and compiled with Ansys system. The relation between cavity radius and projectile velocity in motion process is given by the model.

The simulation results are compared with reference's data.

3 DOF underwater super cavity model of slender body's motion.

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Abstract

In this model the super-cavity arising in 3 DOF underwater motion of slender body is studied using Ansys Fluent Solver Manager. Its velocities in super-cavity situation are solved by sub-models and compiled with Ansys system. The reduction of velocity and cavity radius in

motion process are described by the model. The simulation results are compared with reference's data.

Study to select the fire protection methods for steel structures in Vietnam conditions

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Abstract

According to the Fire and Police Department - Ministry of Public Security, 100% of the load-bearing steel structures collapsed in the real fire with fire temperatures up to 1000 ° C. Thus the study of fire protection solutions for the load-bearing steel structures (beams, columns) is very important in the building. As research shows, there are many solutions for the fire protection of load-bearing steel structures currently used in the world and in Vietnam. Each solution has its own advantages and disadvantages. This paper presents a detail analysis in many aspects (technical solutions, economic) and the choice of the optimal solution in accordance with Vietnam conditions.

Key Words: Steel structures, fire, gypsum plasterboard, fire protection

Study of the parameters influencing the thermal conductivity of gypsum plasterboard under fire action in Vietnam conditions

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Abstract

According to statistics in the world and in Vietnam, fire protection solutions for steel structure (beams, columns) by gypsum plasterboard has many advantages in the fire protection of the structures, especially in high buildings and large span factory. Up to now, on use the constant thermal conductivity to verify the fire capacity of steel structures protected by gypsum plasterboard. However, the thermal conductivity depends on many factors: temperature, moisture, thickness, type of plasterboard, manufacturer, heating rate.... This paper presents a study in the scope of an experimental investigation relative to the characterization of thermal conductivity of plasterboards used to protect steel structure under fire action in Vietnam conditions.

Key Words: Steel structures, fire, gypsum plasterboard, experimental test, thermal conductivity

A Capsule-Based Model to Implement Controllers for Quadrotor UAVs

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Abstract

In this paper, we present a capsule model of Quadrotor Unmanned Aerial Vehicles (UAV) controllers, which is based on the real-time Unified Modeling Language (UML) with a Domain-Specific Language (DSL) of Modeling and Analysis of Real-Time and Embedded Systems (MARTE) and hybrid automata in order to entirely capture the the whole of development phases for control parts of these vehicles. This model can permit us to easily identify design and quickly implement control elements of a Quadrotor UAV, and to customize and re-use them in new applications of UAV control. We bring out step-by-step the UAV controller development lifecycle including the dynamic model and control structure of a Quadrotor UAV combined with hybrid automata in order to obtain the requirement analysis, and the specialization of real-time UML/MARTE's features such as the 'capsules, ports and protocols' notation to completely design structures and behaviors in detail for the control system. Then, the transformation rules are introduced and applied to convert the detailed control design model into the implementation model by using open-source platforms in order to quickly simulate and realize this controller. Based on this approach, a trajectory-tracking controller which permits a Quadrotor UAV to reach and follow a reference trajectory in the *Cartesian* space, is completely developed and taken on trial flights.

Key Words: Quadrotor UAV, hybrid automata, real-time UML, MARTE, capsule collaboration.

Nonlinear hydrodynamic pressure on sloping dams and large radial floodgates during earthquakes

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Abstract

The nonlinear hydrodynamic pressure distribution on the non-vertical upstream face of dams subjected to earthquake ground motions has been analyzed by a CFD approach. The interaction between the dam and the reservoir has been taken into account. The reservoir with free surface is simulated by using a finite volume Navier-Stokes solver in the context of deforming mesh. The dam is modeled as a moving wall during the earthquakes by means of the dynamic update method with remeshing techniques. The effects created by the reservoir length, the upstream shape of dam, and ground motion have been studied. Numerical results in the two-dimensional fluid-structure domain are obtained and compared, which agree well with available experimental results. It is concluded that the proposed method can provide effective and efficient solutions to the hydrodynamic pressure computation.

Key Words: Sloping dam, Radial floodgate, nonlinear hydrodynamic pressure, earthquake excitation, free surface flow, fluid-structure interaction, Navier-Stokes solver

Influence of Upper Rivulet on Aerodynamic Characteristics of Stay Cable under Rain-Wind-Induced Vibration

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Abstract

Rain–wind-induced vibration of taut cables in cable-stayed bridges is presently a worldwide problem of great concern. This phenomenon is sensitively influenced by many parameters. In this paper, a numerical modeling method is presented to evaluate the aerodynamic forces acting on the stay cable of cable-stayed bridge. The effects of characteristic of flow, form, size and location of upper rivulet are also investigate in this paper. The flow around the 2D circular cylinder with an artificial upper rivulet is simulated based on the Navier-Stokes equations and RNG κ-ε turbulent model. The influences of upper rivulet on the air pressure distribution of taut cable is evaluated and compared with previous experimental data. The numerical results show that the location of upper rivulet on the cable surface significantly effects the air pressure distribution and the aerodynamic forces acting on the stay cable.

Key Words: Rain-wind induced vibration; artificial rivulet; computational fluid dynamics; stay cable

Model of mathematical and computation to evaluate the influence of surface lining to the extent and scope of the pollution in the atmosphere.

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Abstract

Over the years, a number of models to assess the spread of air pollution have been made by the team ENVIM have found practical application in air pollution control. However, the mathematical model is not pay attention to the interaction between the gas flow to the surface lining, this will reduce the reliability of the calculated results. Besides, the country's reality needed mathematical model to evaluate the influence of surface lining up air pollution levels. The results of previous studies did not meet this requirement. This paper aims to build mathematical models - information to assess the spread and the dry deposition. Products of this article is the 2014 version CAP software with new features compared to the old version is to assess the degree of influence of the surface lining up air pollution levels. Software is in the process of calibration and verification to be included in the application.

Key Words: Download, diffusion, propagation model quality, the number of calculations, boundary conditions.

3D model of air projectile trajectories

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Abstract

In this 3D model the air projectile motion is studied using Ansys CFX Solver Manager. The forces acting to projectile and its velocity are written in sub-models and compiled with CFX system. The wind effects are considered in the model. The simulation results are compared with reference's data.

Effects of leading-edge figure on Aerodynamic Characteristics of 65° Delta wing

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Abstract

Delta is used for hypersonic flying object. The specific feature of delta wing by comparison with normal wing is that, the lift is created not only by potential flow but also by vortex flow. There are two vortexes along the leading-edge. If the wing is in stability regime, the lift creating by the vortexes helps increase total lift and stall angle of attack is reached to 40°. The creation of vortex is impacted by the figure of leading-edge. The paper presents the result of dependence of aerodynamic parameters and vortexes on the figures of leading-edge by using Ansys software. As the result, the paper brings some evaluation and optimal choice for the figure of leading-edge in the stage of design the wing.

Key Words: delta wing, vortex, gambit, ansys, stall angle…

Calculation and Simulation of Wood Dust Separation and Pollution Spreading in Air of Cyclone System

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Abstract

In this research, the aim of cyclones is extracting dust particles out of hot air stream in order to put into the recovery unit of the system. However, a remaining amount of dust particles will follow out and causing the environmental population and simultaneously causing loss of precious wood pulp material. The purpose of this paper is to build a computational model and simulate two functions including dust particles removal and our estimation for the pollution spreading of exhausted air out of the cyclone system. First of all, finite volume method, the program of ANSYS/FLOTRAN is used to simulate the velocity field of hot air in cyclone system at the wood pulp recovery factory. In specific case, the parameters of efficiency of the dust extracting progress in the case of two parallel cyclones and two series cyclones are shown in this paper. Then, this forecasting model of air pollution spreading from the exit door of cyclone is considered and simulating by AERMOD. Moreover, a difference of cross-section at the outlet of the cyclone is also considered and calculated in two areas of different terrain and meteorological such as Binh Duong and Ha Tinh. The simulation results of the process about dispersing a population level of wood pulp from cyclone system that are compared and displayed in 2D and 3D model through GIS and Google Earth.

Key Words: Wood Dust Separation, cyclone system, Pollution Spreading, ANSYS/FLOTRAN, AERMOD, GIS, Google Earth.

SOLID MECHANICS

Building and Applying a Computer Simulation Program to optimize the Structure of motorcycle helmet under impact

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Abstract

One of important features of safety helmet for motorcyclists is the impact resistance and shock absorption. This is an unsatisfactory feature in most of types of safety helmet certified now. This paper focused on researching the process of impact to helmets and then affect to human heads. Firstly, the original models which include human head will be simulated to impact to flat wall by using LS-DYNA program. This paper will then proceed to compare with the results of impact with helmet protected. Finally, this research will build an application which is in Visual Basic. NET language, has the ability to connect LS-DYNA for calculating, simulating and optimizing helmets to meet different standards in the world.

Key Words: Simulation Technology, motorcycle helmet, impact, optimizing, LS-DYNA, Visual Basic.

Nonlinear dynamic buckling analysis of axially loaded stiffened toroidal shell segments with FGM coatings surrounded by an elastic medium

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[b] University of Transport Technology, Ha Noi, Viet Nam

Abstract

This paper presents an analytical approach to investigate the nonlinear buckling of eccentrically stiffened toroidal shell segments with functionally graded coatings subjected to axial compression and surrounded by an elastic foundation. Based on the classical thin shell theory with the geometrical nonlinearity in von Karman–Donnell sense, Stein and McElman assumption, the smeared stiffeners technique and Pasternak's two-parameter elastic foundation, the governing equations of stiffened shell are derived. The coated toroidal shell segments are reinforced by metal ring and stringer stiffener system. The resulting equations are solved by the Galerkin method and applied Budiansky-Roth criterion to obtain the dynamic buckling loads of shells. Effects of foundation, stiffener system, geometrical and material parameters on the nonlinear dynamic buckling behavior of shells are shown in numerical results.

Keywords: Functionally graded coating; Nonlinear dynamic analysis; Critical buckling load; Toroidal shell segments; Stiffener; Elastic foundation, Axial loading.

Buckling Analysis of Eccentrically Stiffened FGM-Core Layer-FGM Truncated Conical Shells Resting on Elastic Foundations

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[b] Hanoi University of Mining and Geology

Abstract:

In this paper, an analytical solution for buckling of eccentrically stiffened three-layered truncated conical shell consisting of two FGM coating layers and one core layer being metal or ceramic subjected to the axial compressive load and external uniform pressure is developed. Shells are reinforced by stringers and rings in which material properties of shell and stiffeners are graded in the thickness direction with a general model of sigmoid-law distribution. The shell-foundation interaction is described by two- parameter elastic foundation model or Pasternak foundation model. Two models of coated shell-stiffener arrangement are investigated. The change of spacing between stringers in the meridional direction is taken into account. The stability equations for stiffened shells are derived based on Donnell shell theory and smeared stiffeners technique. The resulting equations which they are the couple set of three variable coefficient partial differential equations in terms of displacement components are solved by using Galerkin method. The closed-form expression for determining the buckling load is obtained. The effects of core layer, coating layer, stiffener, foundation and input factors on the stability of shell are considered. The accuracy of the present study is validated by comparing with available result in related literature.

Keywords: *FGM-core layer-FGM truncated conical shell; Stiffener; Elastic foundation; Buckling; Analytical model.*

Buckling Analysis of Eccentrically Stiffened Functionally Graded Plates Resting on Elastic Foundations Based on First-Order Shear Deformation Theory

Dao Van Dung, Le Kha Hoa and Tran Thi Thom

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Abstract

In this paper, the mechanical buckling load of an eccentrically stiffened plate made of functionally graded materials and subjected to in-plane compressive loads resting on elastic foundations is investigated by analytical method. The plates are reinforced by longitudinal and transversal stiffeners. The material properties of plate are graded in the thickness direction according to a volume fraction power-law distribution. The equilibrium and linear stability equations in terms of displacement components for stiffened plates are derived by using the first-order shear deformation theory and smeared stiffeners technique. The solution satisfying the simply supported condition is found in the form of double Fourier series. The closed-form

expression for determine the buckling load is obtained. The effects of stiffeners, foundations, material and dimensional parameters are considered.

Keywords: *Eccentrically stiffened plate; Functionally graded material; Buckling load; Elastic foundation; Analytical method.*

Dynamic response of slender structures under Random Wind Loading accounting the turbulence.

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Abstracts

In this study, the dynamic response of a slender structures under wind loading is investigated. Wind loads are calculated taking into account random properties and the turbulence. Wind velocity is modeled based on Van der Hoven Spectrum and von Karman power spectrum.

Dynamic Response of Structures under Random Wave Loading using Constrained Tromans Wave.

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Abstracts

In this study, random wave is modeling by constraining Tromans wave in to random sequences. The short term wave status are established using the Monte Carlo Technique. Dynamic response of the structures is studied using NewMark algorithm.

On the Nonlinear Stability of ES-FGM Circular Cylindrical Shells under External Pressure on Elastic Foundation

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Abstract

In this paper, the problems on nonlinear buckling and post-buckling of stiffened thin circular cylindrical shells made of functionally graded material (FGM) under external pressure on elastic foundation are investigated by the analytical approach. The shells are reinforced by rings and stringers in which material properties of shell and stiffeners are graded continuously in the thickness direction according to a volume fraction power-law distribution. The formulations are based on the classical shell theory with Pasternak type elastic foundation and with the geometrical nonlinearity in von Karman sense, and smeared stiffeners technique. By applying Galerkin method with three-term solution of deflection, the explicit expression to find critical load and post-buckling load-deflection curves are obtained. Effects of elastic foundation, stiffeners and material and geometrical properties are analyzed.

Keywords: *Functionally graded material (FGM); Stiffened cylindrical shells; Nonlinear buckling; Post-buckling.*

Investigation thinning in sheets hydroforming static via experimental and finite element simulation

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Abstract

Hydrostatic forming technology is a method to form shape sheets, tubes using high pressure liquid. In forming the sheet with complex shape, blank are placed between the die, holder, sealing systems, fluid is injected into the cavity at pressures to 1500 Mpa to form blank follow die shape. The advantage of the technology forming hydrostatic parts sheet over stamping conventional to reduce the number of the opertation, just make drawing die, increasing flexibility in production to facilitate product changing, ensure the accuracy of dimensions ... This article aims to establish a basic understanding of forming the sheet with Hemispherical shape. The effect of hydrostatic pressure on thinning phenomenon in the hydrostatic process of hemispherical shapes with material Laton A70 has been numerically investigated. The forming parameters such as fluid pressure, holder pressure, stroke have been studied by numerical simulation (FEM). The simulation results used to seting up technological parameters in experiment. Finally, some results of the design, development and control of thinning areas during manufacturing of the hemispherical with diameter of 50 mm, thickness of 0.8 mm

Key Words: Drawing, hydrostatic, FEM, thinning, wrinkle, crack, …

Continuous Element formulation for thick composite annular plates and rings resting on elastic foundation

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Abstract

This paper has introduced an efficient approach for analyzing the vibration of thick composite annular plates and rings resting on elastic foundation. The Continuous Element for annular plates and rings on Winkler foundation have been constructed based on the analytical closed form solution of the differential equations of the investigated structure. Numerical results on natural frequencies and harmonic responses of composites annular plates and rings resting on elastic foundation with different boundary conditions have been presented which demonstrated the advantages of the proposed formulation in terms of data storage, computational time saving and high precision in medium and high frequencies.

Key words: Vibration of annular plate, Elastic foundation, Thick composite plate, Dynamics stiffness matrix, Continuous Element Method, Laminate ring, Laminate annular plate.

Stability Analysis of Two – Dimensional Trusses

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Abstract

Trusses structure with pinned joints are frequently used in Mechanical or Civil. Analysis stability structure of trusses requires to solve the geometrically nonlinear problems and the investigation of fundamental equilibrium path. This pager is to present a simple geometric nonlinear formulation based on the Finite Element Method appropriate for truss stability analysis. The implemented programs were coded in a user - friendly computer package like Matlab.

Key word: stability structure, trusses structure, geometric nonlinear

Numerical Analysis of Reinforced Concrete Beams Strengthened with Textile Reinforced Concrete

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Abstract

Strengthening of reinforced concrete structures using textile reinforced concrete (TRC) has emerged as a viable technique to retrofit/repair deteriorated structures. In this study, the flexural performance of concrete beams strengthened with TRC has been investigated by means

of a finite element analysis on ABAQUS software. The work reported in this paper deals with the analytical models, proposed to predict the behavior of reinforced concrete beam strengthened with externally bonded TRC layers. The results of the numerical simulations are used to validate the experimental results.

***Key words**: flexural, strengthening, textile reinforced concrete (TRC), ABAQUS…*

Vibration analysis of cross-ply composite joined conical-cylindrical shells by Continuous Element Method

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Abstract.

A new continuous element (CE) formulation has been presented in this paper for the vibration analysis of cross-ply composite joined conical-cylindrical shells. The differential equations of conical shells are used including cylindrical shells as a special case. Governing equations are obtained using thick shell theory of Reissner, taking into account the shear deflection effects. The appropriate expressions among stress resultants and deformations are extracted as continuity conditions at the joining section. The Dynamic Stiffness Matrix of the structure has been built from which natural frequencies have been evaluated. A Matlab program is written using the CE formulation in order to validate our model. Numerical results on natural frequencies are compared to those obtained by the Finite Element Method (FEM) and validated with the available results in other investigations. This paper emphasizes advantages of CE model in dynamics of complex structures.

Keywords: Cross-ply composite joined conical-cylindrical shells, Dynamics stiffness matrix, Continuous Element Method.

Nonlinear vibration of thick Sigmoid-FGM plates on elastic foundation subjected to thermal load using the third order shear deformation theory

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Abstract

This paper investigates the nonlinear dynamic response of thick Sigmoid-FGM plates using the higher order shear deformation theory and stress function. The S-FGM plate is assumed to rest on elastic foundation and subjected to thermal load. Numerical results for dynamic response of the S-FGM plate are obtained by Runge-Kutta method. The results show the influences of geometrical parameters, the material properties, the elastic foundations and thermal load on the nonlinear dynamic response of S-FGM plates.

***Keywords:** Nonlinear dynamic response, Sigmoid-FGM plate, the higher order shear deformation theory, stress function, thermal load.*

Nonlinear analysis on flutter of S-FGM thin circular cylindrical shells with metal-ceramic-metal layers surrounded on elastic foundations using Ilyushin supersonic aerodynamic theory

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Abstract

This work presents an analysis on the supersonic flutter characteristics of Sigmoid FGM thin circular cylindrical shells with metal-ceramic-metal layers surrounded on elastic foundations under aerodynamic loads. Based on the Ilyushin nonlinear supersonic aerodynamic theory with the classical shell theory, the governing equations of S-FGM shells lying in the moving supersonic airflow are derived. By applying Galerkin method with an approximate two-terms Fourier expansion solution leads to a set of nonlinear auto-oscillation equations for determining the nonlinear flutter response and critical velocity. Numerical results are obtained by fourth-order Runge-Kutta method. The influences of volume fraction index, material and geometrical properties, imperfections, initial conditions and the elastic foundations on the nonlinear supersonic flutter characteristics of S-FGM circular cylindrical shells are investigated.

Keywords: *Nonlinear supersonic flutter, Sigmoid-FGM thin circular cylindrical shells with metal-ceramic-metal layers, the classical shell theory, elastic foundation, stress function.*

Ductile Fracture Analysis of API X65 Steel by Modified Gurson Model in ABAQUS

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Abstract

Ductile fracture of metallic material is usually due to void nucleation, growth and coalescence. To investigate this process, the series of experiments are needed to conduct. This is necessary, but it is quite expensive and time cost. For these reasons, finite element ductile failure simulations based on the local approach is considered as a most effective method and quite useful. In this paper the GTN (Gurson – Tvergaard – Needleman) model was used to analyze the process of ductile fracture in high strength API X65 steel. For detail analyses, the notch round bars and smooth round bar is simulated by the finite element software (ABAQUS) to show the effect of equivalent plastic strain on the void volume growth fraction of the materials. The predictions of ductile behavior in the samples from void nucleation to final failure in material are compared with experimental results and the other analyses.

Keywords: *Ductile fracture, Void growth, Gurson model, Micro-crack mechanism.*

A unified computational framework for theory, modeling and analysis of multilayered plate/shell structures

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Abstract

This article brings to the readers a new unified computational framework for theory, modeling and analysis of multilayered plates/shells via Non-uniform Rational B-splines (NURBS) basis functions in Computer Aided Design (CAD). The idea behind this work is to 1) unify all higher order shear deformation theories in a unique formulation; 2) exploit isogeometric finite element analysis; 3) facilitate the presentation of higher order shear deformation theories in closed-form solutions. Benchmark examples are given to prove high reliability of the present approach and obtained results are compared with a three-dimensional elasticity solution and other numerical solutions.

Keywords: *NURBS, Isogeometric analysis, Multilayered plates, Higher order shear deformation theories, Unified formulation*

Flutter analysis of a high slender damaged structure

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Abstract

This paper presents the effects of dynamic wind load on a high slender cracked structure. When the structure is high and slender, the effects of dynamic wind load on the structure need to be studied. Especially, when the structure has damages such as cracks, the effects of dynamic wind load on the structure need to be investigated carefully to avoid the collapse of the structure during vibration. In this study, the dynamic response of the structure under the dynamic wind load is calculated by using the finite element method. The numerical dynamic responses of the intact structure and the crack structure subjected to the dynamic wind load are obtained and compared to each other to investigate the influences of the cracks.

Keywords: Effects of wind load, crack, slender structure, high structure

Isogeometric analysis of laminated composite plates using a new unconstrained theory

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Abstract

This paper presents a new unconstrained approach based on higher-order shear deformation theory (UHSDT) for static and free vibration analysis of laminated composite plates. The proposed model relaxes zero-shear stresses at the top and bottom surfaces of the plates and no shear correction factors are needed. A weak form of the static, free vibration and response models for laminated composite plates based on UHSDT is then established and is numerically solved using isogeometric analysis (IGA). Some numerical examples for static and vibration analysis are provided. The numerical results demonstrate high efficiency of the present method.

Key Words: Laminated composite plates, isogeometric analysis (IGA), unconstrained theory, static and free vibration analysis.

Yield Surface of Porous Ductile Material Containing Spherical Voids

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Abstract

When micro voids nucleate in a ductile material, the material is changed into a porous material. This porous ductile material is softened with the increasing of its voids volume thus its yield surface is different from that of the original material. This study investigates the yield surface of a von Mises medium containing spherical voids by using a model of a cubic medium and an isolated void with no interaction or coalescence with other voids included. By considered the yield surface as a function of porosity, the result will how the material is softened with the increasing of porosity.

Keywords: Ductile, porous material, void, yield surface

Nonlinear static and dynamic buckling of eccentrically stiffened doubly curves shallow shells with functionally graded coatings resting on elastic foundation subjected to mechanical loads

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Abstract.

Based on the classical thin shell theory with the geometrical nonlinearity in von Karman-Donnell sense, the smeared stiffeners technique and two parameters Pasternak foundation, the governing equations of motion of shallow shells with geometrical imperfections are derived in this paper. The nonlinear static and dynamic buckling and postbuckling of shallow shells acted by axial loading and external pressure are considered. The resulting equations are solved by the Galerkin procedure to obtain the nonlinear static buckling and postbucking behavior in explicit forms. In addition, the nonlinear dynamic responses are analyzed by using Runge-Kutta method and by according to the criterion suggested by Budiansky-Roth, the critical buckling loads are determined.

Keyword: *Functionally graded coating; Buckling analysis; Critical buckling load; Shallow shell Stiffener; Elastic foundation.*

Research on stability of parallel eccentrically stiffened annular spherical segments with functionally graded coatings under mechanic loads

Nguyen Thi Phuong[a], Dao Huy Bich[b]

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Abstract

Governing equations of eccentrically stiffened annular spherical segments with functionally graded coatings in two surfaces are derived by using the Donnell's theory and Lekhnistkii's smeared stiffeners technique to investigate the buckling of shell segment subjected to compressive load and radial pressure. The shell segment is reinforced by parallel eccentrically isotropic stiffeners system. Approximate solutions are assumed to satisfy the simply supported boundary condition and Galerkin method is applied to obtain closed-form relations of bifurcation type of buckling loads. Numerical results are given to evaluate effects of stiffeners, material and dimensional parameters to the buckling behavior.

Key Words: functionally graded material; annular spherical segment; critical buckling load; parallel stiffener.

Numerical Aspects of a Time Integration Scheme for Dynamic Analysis of Structures

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Abstract

In this article, we investigate numerical aspects of a new time-integration scheme for dynamic analysis of structures. This scheme assumes the acceleration in each time step to be of cubic polynomial. The polynomial function for the displacement thus has six unknown coefficients. The six equations used to find them are the two initial conditions from preceding step, two equations from the system equilibrium at the both ends of current time step, and the last two equations being the conditions for optimum value of integral of squared residue over the step length. Compared with other methods (the central difference method, the β-Newmark methods, the Houbolt method, and the Razavi method), the proposed scheme was shown with its high accuracy. In this article, we further investigate the stability and the convergence rate of the scheme. The results from numerical examples show that this improvement is significant.

Key words: dynamics, dynamic analysis, time integration, numerical stability, accuracy, convergence, numerical metho

Research of Blast Wave Propagation in Soil Environment

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Abstract

This paper presents the research results of blast wave propagation in soil environment in case of the changing environmental parameters. The state-space equations are used to describe the various states of the soil under the pressure of the blast waves. The TM5 standard to calculate the blast loading is applied to make a comparison and verification. Autodyn software is employed to study.

Keywords: Blast loading, blast wave propagation, soil environment

Study on the propagation of blast wave in coral medium and interaction with the works having soft structure

Nguyen Huu The, Vu Đinh Loi

Abstract

The article presents the experimental method to determine the process of interaction between works having soft structure with surrounding coral environment when the blast wave propagates. This is aimed at purpose of computation, design and construction of works for national defense and security, from that, drawing the conclusion as the basis to apply in reality.

***Key Words**: Blast loading, blast wave propagation, soil*

Fuzzy structural analysis using improved differential evolutionary optimization

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Abstract

The α-level optimization is known as a general approach for fuzzy structural analysis. The applicability of this strategy, however, relies on the robustness of the optimization techniques used. In this study, an efficient optimization algorithm for the fuzzy analysis of structural systems using the Differential Evolution (DE) in combination with the α-level optimization is proposed. In order to improve the computational efficiency, two novel techniques are introduced into the conventional DE to reduce the number of solution steps required in the estimation of fuzzy model outputs. First, in optimization process at each α-level, a simple comparison using nearest neighbor solution points is applied to early avoid possibly unnecessary model evaluations. Second, the algorithm uses the optimization results at higher α-levels to locate the feasible region for global optima at the lower level. The algorithm is simple, easy to implement and robust. The computational benefits and applicability of the improved differential evolutionary optimization in the context of fuzzy analysis are demonstrated on some numerical examples.

Key words: fuzzy structural analysis, global optimization, differential evolution

Multiscale analysis of the stress singularity order of $Pb(Zr_xTi_y)O_3$/Si bi-material.

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Abstract

PZT/Si bi-material have been widely used in technology applications, eg, actuators in MEMS/NEMS and nonvolatile random access memories (FeRAM). The emphasis of this paper is to analyze the stress singularity order λ at the interface of $PbTiO_3$/Si, $PbZr_{0.5}Ti_{0.5}O_3$/Si, $PbZrO_3$/Si based on multi-scale method. The models with the surface-interface angle in the range from 45^o to 180^o are implemented by finite element method (FEM). Material parameters including Young modulus, elastic constants, Poission ratio of PZT and Si are evaluated by ab initio density-functional theory calculations. The obtained results reveal that the stress singularity order λ increases with increasing rate of Zr in PZT.

Keywords: Elastic constants, Ab initio, density-functional theory, stress singularity order.

Nonlinear dynamic analysis and vibration of imperfect three phase polymer nano-composite panel resting on elastic foundation under hydrodynamic loads

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Abstract

An investigation on the nonlinear dynamic response and vibration of the imperfect laminated three phase polymer nano-composite panel resting on elastic foundations and subjected to hydrodynamic loads is presented in this paper. The formulations are based on the classical plate theory and stress function taking into account geometrical nonlinearity, initial geometrical imperfection and Pasternak type elastic foundation. Numerical results for dynamic response and vibration of the three phase polymer composite panel are obtained by Runge-Kutta method. The influences of fibers and particles, material and geometrical properties, foundation stiffness, imperfection and hydrodynamic loads on the non linear dynamic response and nonlinear vibration of the three phase composite panel are discussed in detail.

Keywords: *Nonlinear dynamic, vibration, laminated three phase polymer nano-composite panel, hydrodynamics loads, imperfection, elastic foundation.*

Effect parametric to properties of a 2D orthogonal plain classical woven fabric composite

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Abstract

In this paper, an analytical model for the prediction of the effective properties of a 2D orthogonal plain classical woven fabric composite (OPCWFC). Available methods for micromechanical prediction of effective properties of fiber reinforced material were presented. First, the composite representative volume element (RVE) or the so called unit cell was discussed through the existing models in the literature. The micro structure of the fabric was studied under a microscope. From these observations, it seemed necessary to use sinusoidal shaped functions to take the yarn undulation into account. Each yarn in the RVE was modeled as a transversely isotropic linear elastic solid and the contribution from each yarn to the RVE elastic stiffness was obtained by the volume averaging method. The model base relied on the concentric cylinders

model (CCM). The fabric was performed using a 2D orthogonal EW220 glass fiber PWFs, infused with 5284 epoxy resin.

Analyses have been performed in an attempt to ascertain the effects of various geometric parameters on the elastic properties of plain woven composites. A set of parameters has been selected which can greatly affect the fabric geometry or the elastic property of the fabrics: the yarn aspect ratio, the fiber volume fraction in a yarn, the gap length and the constituent materials.

Keywords: orthotropic woven fabric, orthogonal classical plain mechanical, concentric cylinders model

The method of Calculation on Fatigue Failure at welding joint in the conveyor screw carrying bulk materials rely with view of point on Fracture Mechanics

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Abstract

Today, with the explosive growth of the industry of mass production. The question is how to transport goods as soon as possible. With the invention of the conveyor screw, freight tasks become simpler and more convenient, especially to carry bulk material which have high temperature. However, the biggest drawback of it is weld between the screw and shaft twisted off easily ruined by fatigue. Many documents stills focus on classical machines to deal with the cycle load which mainly caused damage fatigue to conveyor screw. They are restricted when solve with cracks by fatigue. To improve the longevity of screw conveyor cannot ignore researching the destruction caused by fatigue of welds. Theory of fracture mechanics becomes compulsory theory to calculate fatigue weld in conveyor screw. The life of conveyor depends on weld between screw and shaft. Few documents mention this problem. In this paper, the affection of fatigue to strengthen of conveyor screw will be showed. It will be presented the method of calculation on the fatigue failure from theory of Fracture Mechanics

Key words: Crack types, Weld joints, conveyor screw, fatigue crack

Extended finite-element method for modeling circular and elliptical hole in functionally graded material plate

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Abstract

In this article, the effect of circular and elliptical hole in functionally graded material (FGM) plate is considered. A methodology to model holes without meshing the internal boundaries is proposed. The numerical method couples the level set method to the extended finite-element method (X-FEM). In the X-FEM, the finite-element approximation is enriched by additional functions through the notion of partition of unity. The level set method is used for representing the location of holes. Numerical examples are presented to demonstrate the accuracy and potential of the new technique.

Key Words: Extended finite-element method; Level set method; holes; functionally graded material

Nonlinear Dynamic and Vibration of Imperfect Sigmoid-Functionally Graded Double Curved Shallow Shells Resting on Elastic Foundation using the First Order Shear Deformation Theory

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Abstract

An analytical approach to investigate the nonlinear dynamic response and vibration of imperfect Sigmoid-functionally graded (S-FGM) double curved shallow shells on elastic foundation using both of the first order shear deformation theory and stress function is presented. The volume fractions of metal and ceramic is applied by Sigmoid-law distribution with ceramic-metal-ceramic layers. The FGM shells are assumed to rest on elastic foundation and subjected to mechanical and damping loads. Numerical results for dynamic response of the FGM shells are obtained by Runge-Kutta method. The effects of geometrical parameters, the material properties, imperfections, the elastic foundations and mechanical loads on the nonlinear dynamic response and nonlinear vibration of Sigmoid-functionally graded double curved shallow shells are discussed in details. The results are compared with the known results in the literature.

Keywords: *Nonlinear dynamic response, vibration, Sigmoid-FGM double curved shallow shells with ceramic-metal-ceramic layers, the first order shear deformation theory, stress function.*

Free vibration analysis of Reissner – Mindlin functionally graded plates by finite element method

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Abstract

In this paper, finite element formulation of functionally graded plates based on first-order shear deformation theory is presented for free vibration analysis. An eight-nodded rectangular isoparametric element with five degrees of freedom per node is used. Poisson's ratios, Young's modulus and material densities vary continuously in thickness direction according to the volume fraction of constituents which is modeled as power law functions. Parametric studies are performed for varying volume fraction distributions, aspect ratios and side-to-thickness ratios. Results are verified with available results in the literature.

Keywords: Free vibration analysis, functionally graded plate, Reissner-Mindlin shear deformation theory, finite element method

Vibration of a composite truncated conical shell filled with fluid

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Abstract

Free vibration of a fluid-filled cross-ply laminated composite vertical truncated conical shell is investigated using a Continuous Element Method based on the Reissner–Mindlin theory and non-viscous incompressible fluid equations. Numerical examples are given for free vibrations of clamped-free conical shells partially and completely filled with fluid. Numerical results indicate that the fluid filling can reduce significantly the natural frequencies of composite conical shells. Parametric studies including circumferential wave number, fluid depth, length to mean radius are carried out.

***Keywords**: Free vibration, Continuous Element Method, Cross-ply laminates, Conical shell, Fluid-Shell interaction.*

Free vibration of fluid-filled laminated composite cylindrical shells on elastic foundations

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Abstract

In this paper, free vibrations of completely fluid-filled composite circular cylindrical shells on Winkler and Pasternak elastic foundations are studied. The Dynamic Stiffness Method is employed to solve the cylindrical shell problem. Natural frequencies for both empty and fluid-filled cylindrical shells based on elastic foundations are evaluated and their comparisons are performed to confirm the validity and accuracy of the present method. An excellent agreement has been found between the present and previous ones available in the literature. It is observed that frequencies are strongly affected when a cylindrical shell is attached with elastic foundations.

Keywords: Free vibration, Fluid-filled composite cylindrical shells, Dynamic Stiffness Method, Winkler and Pasternak Elastic foundations.

Numerical-Experimental studies on free vibration of laminated glass fiber/polyester truncated conical shells containing fluid

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Abstract

The present work deals with a numerical-experimental investigation on free vibration of clamped-free glass fiber/polyester vertical conical shells containing fluid. The tests have been carried out by using a multi-vibration measuring machine (DEWEBOOK-DASYLab 5.61.10) to determine the natural frequencies of the composite conical shells with various types of geometry and different fluid depths.

The natural frequencies of the above tested conical shells containing fluid were determined by using a Dynamic Stiffness Method of Continuous Elements (CEM) based on the Reissner–Mindlin theory and non-viscous incompressible fluid equations.

The results calculated by computational model for studied composite conical shells are in good agreement with experiments.

Keywords*: Experimental study, Free vibration, Glass fiber/polyester composite conical shell, Dynamic Stiffness Method, Fluid-Shell interaction.*

Analytical solution for axisymmetric bending of radially functionally graded circular plates

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Abstract

An analytical solution for axisymmetric bending of radially functionally graded (RFG) circular plates is developed based on classical plate theory. The deflection, stresses are presented to investigate the effects of the power-law indexes and geometrical parameters of the circular plate. The effect of variation of materials properties in term of power-law index on the

axisymmetric bending behavior of RFG circular plates is studied. The validation of the results is done by a comparison with another study.

Keywords: Analytical solution, axisymmetric bending, radially functionally graded circular plate.

Vibration analysis of exponentially graded plates using various shear defomation plate theories

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Abstract

The main objective of this paper is to present analytical solutions for free vibration analysis of moderately thick rectangular plates, which are composed of exponentially functionally graded materials (E-FGMs). Equations of motion are derived using Hamilton's principle. The various shear deformation plate theories are used for developing Navier's solutions of simply supported rectangular plates. The effects of volume fraction distributions, plate aspect ratio, and side-to-thickness ratio are studied.

Keywords: Vibration analysis, exponentially functionally graded plate, shear deformation plate theory.

Analytical solutions for bending response and free vibration analysis of exponentially graded rectangular plates

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Abstract

Analytical solution of a simple first-order shear deformation theory that accounts for the exponential law distribution of two materials through thickness is presented. The governing equations of exponentially graded plates and boundary condition are derived by employing the Hamilton's principle. Navier solution method is used to solve the equations of motion. The effect of variation of materials properties in term of power-law index on the bending behavior of E-FGM plates is studied. The validity of the present solution is demonstrated by comparison with available in the literature.

Keywords: *analytical solutions, bending response, free vibration analysis, exponentially graded rectangular plates*

Amplification of the surface layer to the body waves

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Abstract

The H/V (horizontal to vertical displacements) ratio technique was developed by Nakamura and has been used widely in recent decades. It helps determine the effects of the surface layer when there is an earthquake to the ground. Since the recorded H/V ratio spectra on the ground are composed by various types of waves, the basis of the H/V ratio technique contains some assumptions about the origin of this ratio and about its two horizontal and vertical components based on real recorded data from earthquakes. In this study, the Reflection/Transmission theory is used to calculate the amplification of the surface layer to the body waves. These amplifications will be used to check the H/V ratio technique's assumptions systematically and illustrate their validity.

Key Words: H/V ratio method, body waves, local site effects, R/T theory.

Static analysis of stiffened laminated composite cylindrical shell using finite element method

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Abstract

An eight-node isoparametric element has been introduced for the static analysis of stiffened laminated composite cylindrical shell. First order shear deformation theory is used in the present study. The stiffness matrix so computed for the stiffener is then transferred to that of the plate/shell element nodes depending on its position and orientation within the element before assembling the element stiffness matrix. Numerical examples are compared with the available analytical and numerical solutions presented in literature. Results of static analysis of stiffened cylindrical shells are discussed.

Keywords: Laminated composite shells, stiffened shells, static analysis, finite elements

Dispersion equation of Rayleigh surface waves in stratified layer by ray and R/T theories

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Abstract

There are several theories to obtain the dispersion equation of Rayleigh surface waves in stratified layer. Each of them has its own advantages and disadvantages. The R/T theory is systematic but does not show the physical origin of Rayleigh waves. In contrast, the ray theory

reflects clearly this physical origin but is not formulated in a systematic way. One can say that the R/T theory is a mathematical method while the ray theory is a physical method. In this study, these two methods are combined so that not only the origin of Rayleigh surface waves is clear but the dispersion equation is obtained in a systematic way also.

Key Words: Rayleigh waves, Ray theory, R/T theory.

Nonlinear post-buckling analysis of thin Sigmoid FGM annular spherical shells surrounded on elastic foundations under uniform external pressure including temperature effects

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Abstract

To increase the thermal resistance of various structural components in high-temperature environments, the present research deals with nonlinear post-buckling of thin annular spherical shells made of functionally graded materials on elastic foundations under uniform external pressure and temperature. The annular spherical shell structure is bounded by the outer of ceramic-rich surface and the middle of metal-rich surface with Sigmoid power law distribution (S-FGM) in terms of the volume fractions of constituents. Equilibrium and compatibility equations for annular spherical shells are derived by using the classical thin shell theory in terms of the shell deflection and the stress function. Approximate analytical solutions are assumed to satisfy simply supported boundary conditions and Galerkin method is applied to obtain closed – form of load – deflection paths. An analysis is carried out to show the effects of material, geometrical properties, mechanical and thermal loads on the stability of the annular spherical shells.

Keywords: *Nonlinear post-buckling, annular S-FGM spherical shells, elastic foundations, the stress function, external pressure, temperature effects.*

Nonlinear response of axisymmetric shear deformable Sigmoid FGM shallow spherical shells resting on elastic foundations under external pressure

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Abstract

This paper presents an analytical approach to investigate the nonlinear buckling of moderately thick functionally graded material shallow spherical (SS) shells with ceramic-metal-ceramic layers resting on elastic foundations, subjected to uniform external pressure. Material

compositions of the shell are varying smoothly through the thickness according to a Sigmoid power law distribution (S-FGM) with ceramic-metal-ceramic layers. Formulations for the axisymmetric shear deformable SS shells are based on the first order shear deformation theory taking geometrical nonlinearity, interactions of Pasternak type elastic foundations are into consideration. Approximate solutions are assumed to satisfy clamped immovable boundary conditions and Galerkin method is applied to derive expressions of buckling loads and load–deflection curves for S-FGM SS shells. The effects of materials, geometry, elastic foundation on the nonlinear buckling and post-buckling of S-FGM SS shells are analyzed and discussed in detail.

Key Words: Nonlinear buckling, thick S-FGM shallow spherical shell with ceramic-metal-ceramic layers, elastic foundation, external pressure

Experimental study of determining reflected waves on the underwater structures

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Abstract

Theory of explosion shows that, for each an impact surface and a relative position of the impact surface and the incident wave, a reflected wave can appear and have different magnitude. To determine the reflected waves from obstacles in the water environment should have to the underwater explosion test and measurement equipment used appropriately. In fact, the studies which determining the magnitude of reflected shock wave when interacted with underwater obstacles are rarely published so the comparison between experiment with theory rarely been tested. This paper presents model and experimental results of the underwater explosion belongs to topic KC09.06/11-15 in the Vietnam's Archipelago Truong Sa (Spratly Islands) in order to determine the magnitude reflected waves in the model experiment was set up.

Key Words: underwater explosion, reflected waves, incident waves, explosive experiments, structure

Nonlinear Dynamic Buckling of Functionally Graded Cylindrical Shells with Different Eccentrically Stiffener Forms under Axial Compression and External Pressure

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Abstract

In the present work, the study of the nonlinear dynamic buckling problem of functionally graded circular cylindrical shells with different eccentrically stiffeners forms subjected to time dependent axial compression and external pressure is presented. The shells are reinforced by rectangular, T or I stiffeners system. Governing equation is derived by using the classical thin shell theory with the geometrical nonlinearity in von Kármán–Donnell sense, the smeared

stiffener technique and Galerkin method. The nonlinear dynamic responses are obtained by Runge-Kutta method and the nonlinear critical dynamic buckling load of stiffened functionally graded shells under linear-time loading is determined by Budiansky–Roth criterion. Effects of stiffener, geometric and material properties on the nonlinear dynamic buckling behavior of stiffened functionally graded circular cylindrical shells are discussed by numerical results.

Interface structure and mechanics of Ag/Al multi-layers: an *ab initio* study

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Abstract

Multi-layer materials is a fascinating not only for technological applications, but also as a test bed for fundamental insights into fracture mechanics due to its unique structure. In particular, the interface between metal and other metal is of critical importance in micro-electro-mechanical devices (MEMS, NEMS). In this study, we investigate the structure and mechanical interfaces of Ag/Al multi-layers under axial strain through ab initio density functional theory (DFT) calculations. Interface strength was calculated based on the surface energy. In addition, the elastic constants and ideal strength were investigated as well.

Keywords: Ideal strength, Ab initio, density functional theory, thin film, surface.

DYNAMIC AND CONTROL

Vibration control of a beam using on off damping

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Abstract

This paper considers the vibration control problem of a beam under harmonic excitation (and attached) with an on-off damper. By approximating the beam as a multi-degree-of-freedom system, an analytical solution of the problem is derived. Some effects of the on-off damping are revealed, which includes: the positions the some special points, the adaptive nature of the equivalent on-off damping, the influences of the damper's position. A numerical example is carried out to demonstrate the analytical predictions.

Probabilistic behaviors of Mathieu- Duffing oscillator under external periodic and random excitations

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Abstract

This work investigates probabilistic behaviors of the Mathieu-Duffing equation under external periodic and random excitations by employing the technique introduced by Anh et al. (2014), which combines the stochastic averaging method and the equivalent linearization method. The effect of various parameters on the response of the system is demonstrated. The marginal probability density function of the response at a particular time is determined. The theoretical analyses of Mathieu-Duffing oscillator are validated by numerical simulation.

Key Words: Mathieu, averaging method, equivalent linearization, harmonic, random.

Gear Fault Identification using Artificial Neural Network and Wavelet Packet Transform

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Abstract

This paper proposes a new procedure for classification of gear fault such as normal gear, slight - and medium - worn and broken – teeth using multi-layer perception neural network (MLP network). Measured vibration signals are processed by the wavelet packet transform with Daubechies wavelet function. Feature vector - one of the most significant parameter to design an appropriate neural network, is innovated by standard deviation of wavelet packet coefficients. In this study, the wavelet packet decomposition applied up to the 4 level thus giving 16 signal coefficients with their corresponding standard deviations used as 16 input of MLP network. There are four neurons of output layer in MLP network obtained from four gear fault. Classification results show that the proposed approach can be used to automatically detect and identify gear faults in transmission system.

Keywords: *Gear fault, diagnosis, Neural network, wavelet packet, vibration signal.*

Dynamics and position control of Teleoperation – Mobile robot

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Abstract

This paper focus on our proposal of a control law method for the Bilateral Teleoperation System with mobile robot, This system is composed by a Master Robot and a Mobile-Slave Robot. Using passive decomposition method, this study indicates when the Slave Robot (mobile robot) is remotely controlled through the Master Robot (two degrees of freedom robot arm). It is possible to linearly control velocity and movement of the Mobile-Slave robot. The simulation results demonstrate the effectiveness of the proposed method in case the delay on telecommunication channel to be concerned.

Key words: mobile robot, Teleoperation-mobile robot system, dynamics

Phononic band gap characteristics of wave propagation in a two-dimensional brick wall-like periodic square lattice structure

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Abstract

In problems of wave propagation through a medium of periodic lattice material, phononic band gap phenomena exhibit important characteristics in which the lattice material can prevent elastic waves in a certain frequency range. The band gap can be used for applications, for example, frequency filters, sound/vibration protection devices, or wave guides. In this study, we explore phononic band gap characteristics of the wave motion when a wave propagates through a reticulated cellular structure called *brick wall-like periodic square lattice*. From numerical calculations based on two approaches, namely, the finite element method and Floquet-Bloch principle, it is found that the band gap strongly depends upon geometry parameters of the lattice, such as the slenderness ratio of the constituent beam. The obtained results are useful for providing a guide in designing band gap of the lattice for desired functions.

Energy-based Controller with Optimization Tuning by Using Genetic Algorithm for Overhead Cranes

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Abstract

This paper presents a combination of a nonlinear PD controller and genetic algorithm to design an optimal controller for a nonlinear overhead crane system. The nonlinear PD controller is derived based on passivity of the system and genetic algorithm is exploited to find optimal parameters for the controller. The system dynamic model is derived by using Lagrangian equation. Simulations are conducted within Matlab environment to determine the optimal control parameters and to verify the performance of the controller. It is demonstrated that the controller is effective to move the trolley as fast as possible to the desired position while the oscillation of the payload is suppressed at the end of the operation. The robustness of the controller against uncertainties in cable length and payload is also indicated by the simulations.

Keywords: underactuated nonlinear systems, overhead crane, energy-based control, optimal control, genetic algorithm.

Modeling and simulation of translational single flexible manipulator

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Abstract

Material handling machine are widely used in stores or factory. In cases of high speed operation or machines with slender links the vibration phenomenon becomes remarkable. This paper presents the modeling and simulation of a translational single flexible manipulator. Firstly, free vibration of continuous cantilever beam is under consideration to determine its mode shapes. By using this mode shapes, then, the equations of motion for the translational elastic beam is established. Numerical simulations in Matlab are implemented to show the effect of the flexibility to the response of the system.

Keywords: flexible robotic manipulators, Euler- Bernoulli beam, PD controller.

Dynamic response of a double cracked beam subjected to a moving load

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Abstract

This paper presents the dynamic response of a double cracked beam subjected to a moving load. The modal of a double cracked beam is modeled by using finite element analysis. In this study, the influence of cracks on the dynamic response of the beam is investigated. The surface roughness of the beam is taken into account. The influences of the surface irregularity depth and length on the dynamic response of the beam are studied. Using wavelet transform, the cracks can be detected. Numerical results are also provided in this paper.

Keywords: double beam, crack, moving load, surface roughness, crack detection

Dynamic analysis of a double cracked beam with an attached mass-spring-damper system subjected to earthquake excitation

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Abstract

This paper presents the dynamic response of a double cracked beam with an attached mass-spring-damper system subjected to earthquake excitation. The modal of a double cracked beam is modelled by using finite element analysis. In this study, the influence of spring and damper on the vibration amplitude of the double beam are investigated. The influence of

position of the attached mass-spring-damper system on the vibration of beam is also studied. Numerical simulation results are presented in this paper.

Keywords: double beam, earthquake, turned mass damper

An approximation to the characteristic equation of multiple cracked beam

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Abstract

The characteristic equation for multiple cracked beam has been conducted in various forms by numerous authors, however, it was implicit with respect to the crack parameters. So, application of the characteristic equation for multi-crack identification leads to solve an incorrect inverse problem. Therefore, simplifying the equation with the aim to reduce the incorrectness of the crack identification problem presents a subject of interest. This presentation reports on a novel approximation of the equation that is an explicit expression in terms of crack severities and makes possible to use the crack scanning method to detect unknown number of cracks in beam by measurement of natural frequencies. Numerical examples are examined to validate usefulness of the derived approximate characteristic equation in comparison with the exact one.

Key Words: Multiple cracked beam; characteristic equation; modal analysis

Improvement of Flutter Instability in Long-Span Cable-Supported Bridge by Investigating the Optimum Box Section Geometry

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Abstract

Wind-induced vibration is an important source of loads on bridge structures, whereas aerodynamic instabilities are very dangerous and may cause the bridge to collapse; therefore they are much important considerations in long span bridge design. Since the collapse of the original Tacoma Narrows bridge in 1940, flutter instability had become the most important problem for cable bridges. One design approach is streamlining box girder cross-section with various aerodynamic attachments. In order to increase flutter stability, this paper proposes some technical solutions for the box girder cross-section of cable-supported bridge by varying the combination between fairing angles and position of separation point of box section.

The problem was solved by applying computational fluid dynamics (CFD) method, known as "numerical wind tunnel". Currently, methodology of CFD has gradually been accepted for analyzing the problem of interaction between wind flow and structures, especially for determining the aerodynamic parameters. This computational approach gave a good agreement with wind tunnel test results of Thuan Phuoc bridge, which is the longest suspension bridge of Vietnam, located in Danang city. By simulating many cross sections series with different fairing angles, separation point and bridge widths, it was found that flutter instability was prevented in some range of aerodynamic attachments dimensions. The detail is further discussed in the full paper.

Key Words: Flutter Instability, CFD, Fairing, Aerodynamic Attachments, Cable-Supported Bridge.

Calculating periodic and chaotic solutions of piecewise-linear systems using matrix exponential

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Abstract

Piecewise-linear systems are strong nonlinear systems with diversity of behavior from periodic to chaotic solutions. The coefficients of the equations describing this kind of system can be considered to be constant but will change depending on the position of the system. This characteristic leads to difficulties in calculating with normal ODE solvers. In this paper, a method of pseudo-variable will be introduced to convert non-autonomous systems into autonomous ones and an algorithm using matrix exponential will be applied to solve the latter. The obtained results show that this method can be used to find periodic solutions as well as chaotic solutions of piecewise-linear systems with advantages in computational speed and accuracy.

Sliding Mode Control of a Continuously Variable Transmission During Shifting

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Abstract

Continuously Variable Transmission (CVT) is a transmission that can change seamlessly through an infinite number of effective gear ratios between maximum and minimum values. The transmission ratio continuous variation allows the engine to function at the engine's most efficient RPM zone. In the CVT powertrain, the management of the variator during shitting is a key point especially when considering driving comfort and fuel efficiency. In this paper, we propose a control law for CVT variator management based on sliding mode control. The goal of the control law is to track the desired CVT ratio to ensure fuel economy. Several simulation results are provided to show the efficiency of developed control law.

Optimal Control for Variable Stiffness System by Using Bang-Bang Technique

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Abstract

Variable stiffness actuators are used more and more in robotic manipulators and robotic hands due to their flexibility. By using variable stiffness actuators the safety of the robotic device with respect to interaction with unknown environment, unexpected collisions, and actuator failures is improved. This paper presents the dynamic model of a two-link manipulator that is controlled by variable stiffness actuators. The optimal control for this manipulator is formulated in sense of maximum throwing distance of a ball that attached at the end of the manipulator. By combination of bang-bang control technique and the Nelder-Mead algorithm the optimal input control is determined. Numerical simulations in Matlab are carried out to verify the efficiencies of the proposed method.

Keywords: variable stiffness actuators, mathematical models, robotic manipulators, optimal control.