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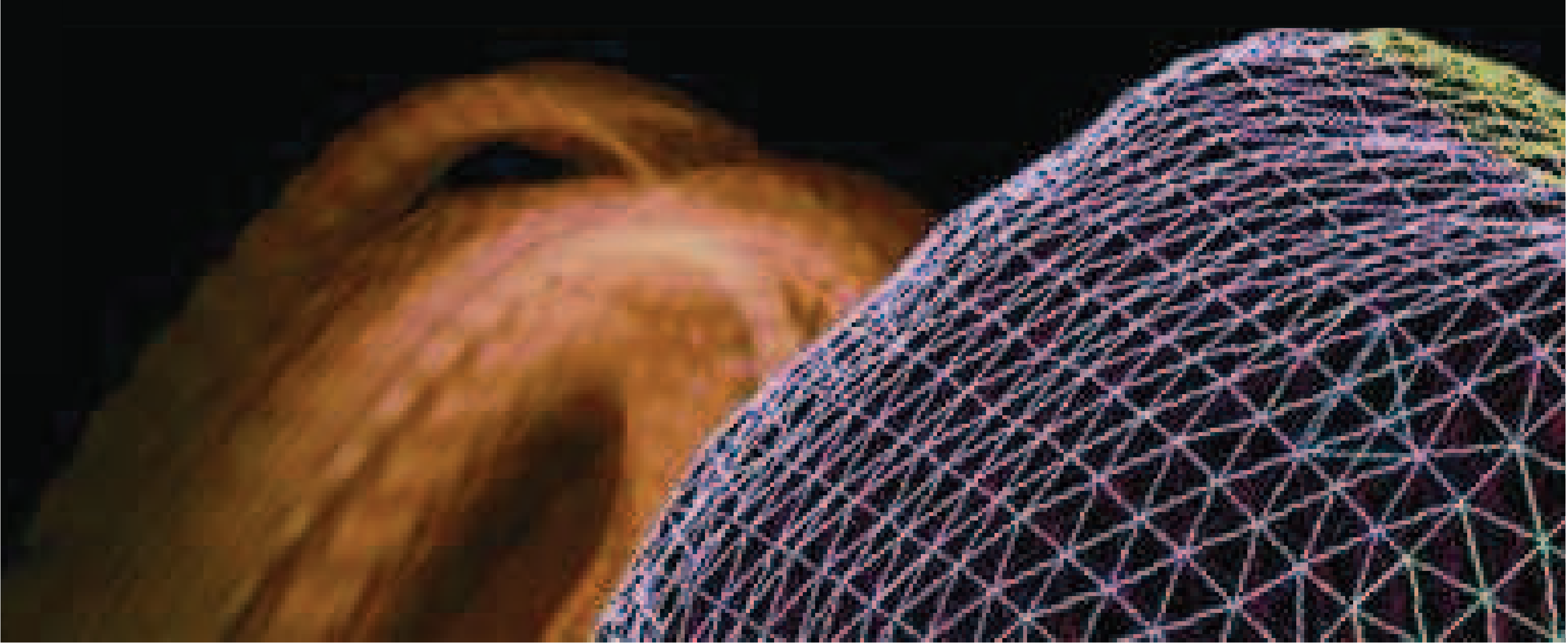
MULTIPHYSICS 2009

9 - 11 December 2009
Lille, France



MULTIPHYSICS 2009

09-11 December 2009
Lille, France

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General Information

Scope of Conference

Understanding real physics and performing multiphysics simulation are extremely important to analyse complex systems in order to better design and manufacture engineering products.

The objective of the conference is to share and explore findings on mathematical advances, numerical modelling and experimental validation of theoretical and practical systems in a wide range of applications.

The scope of the conference is to address the latest advances in theoretical developments, numerical modelling and industrial application which will promote the concept of simultaneous engineering. Typical combinations would involve a selection from subject disciplines such as Acoustics, Electrics, Explosives, Fire, Fluids, Magnetic, Soil, Structures and Thermodynamics.

Registration Pack – Collection Hours

Registration packs should be collected from the Registration Desk. Collection Hours are as follows:

Wednesday, 9th December	11:00-17:00
Thursday, 10th December	09:00-17:00
Friday, 11th December	09:00-12:00

Special Events

- Wednesday 18:00
  Welcome Reception

- Thursday 19:00
  Conference Banquet

Timing of Presentations

Each paper will be allocated 18 minutes. A good guide is 14 minutes for presentation with 4 minutes left for questions at the end.
Good timekeeping is essential, speakers are asked to keep strictly to 18 minutes per presentation.

Language

The official language of the conference is English.

Audiovisual

The lecture room will be preset with the following:
One laptop, one LCD projection and cables, one screen, and one microphone.
Delegates are requested to bring presentations on CD or memory stick.

Paper Publication

Selected papers are reviewed and published in 'The International Journal of Multiphysics'.

Sponsorship

The Conference Board would like to thank the sponsors for their support.

Keynote Speaker

Professor A Holdø
Narvik University College, Norway

BIOGRAPHY

Professor Holdø is at present Vice Chancellor of Narvik University College. He has more than thirty five years experience in non-linear and fluid dynamics analysis and other Multi Physics disciplines using computational and experimental methods.
Professor Holdø has been an invited lecturer at many conferences and meetings as well as on postgraduate courses at a number of universities. He has been a member of the Organising Committees for Conferences for Computational Methods in Medicine (CMM) and Computational Fluid Dynamics applied to the Safe Design of Offshore Structures. He has also an international experience in examination of PhD students based in Europe, India, UK and the USA. He has supervised 40 successful post graduate research degree students (PhDs).

Professor Holdø has been awarded research grants from the BBSRC, EPSRC, NFR, EU Framework 5, 6 and 7. He has been an external consultant to a number of companies and research institutes such as Bechtel, Thames Water, IBM, the Norwegian Defence Research Establishment, Phillips Petroleum, British Aerospace, AGIP and Techno Consult a/s (now part of Norconsult). Professor Holdø has also been an expert witness on several occasions. Examples are expert witness at the Piper Alpha litigation case at the High Court of Scotland (1992) and the more recent occasion was in the “Contship France” case in London.

Professor Holdø has had Chairs in Fluid Mechanics at the University of Hertfordshire and in Energy and Environmental Technology at Coventry University as well as several visiting Professor positions. He has more than 200 publications and holds the Stanley Gray Award for best paper read to the Institute of Marine Engineers, the Denny Gold Medal for best paper, Institute of Marine Engineers and an Outstanding Technical Paper Award from the American Society of Mechanical Engineers
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MULTIPHYSICS 2009

Programme

Time	Wednesday 9 Dec 09	Thursday 10 Dec 09	Friday 11 Dec 09
09:00 – 10:30		Session 2.1 *Micromechanics*	Session 3.1 *New Applications*
10:30 – 11:00	Coffee Break		
11:00 – 12:30	Registration	Session 2.2 *Impact and Explosions*	Session 3.2 *Heat and Hydrodynamics*
12:30 – 13:30	Lunch		
13:30 – 15:00	Keynote Address	Session 2.3 *Material Physics*	
15:00 – 15:30	Tea Break		
15:30 – 17:00	Session 1.4 *Fluid Structure Interaction*	Session 2.4 *Modelling Advances*	
18:00	Welcome Reception		
19:00		Conference Banquet	

Full Programme

Wednesday 9 December 2009

11:00 **Registration**

14:00-15:00 **Keynote Address**

Chair: M Moatamedi, Narvik University College, Norway

Multiphysics Challenges for Renewable Energy Devices
A E Holdø, Vice Chancellor, Narvik University College, Norway

15:00-15:30 **Tea Break**

Wednesday 09 December 2009

15:30-17:00 Session 1.4 *Fluid Structure Interaction*

Chair: T. Rahulan, University of Salford, UK

Ale and Fluid Structure Interaction – Applications for industrial problems
M'hamed Souli, Universite des Scices de Lille, France

Numerical investigations in mixed friction systems
Albert Albers, Benoit Lorentz, Lukas Nowicki
Institut of product development (IPEK), Karlsruher Institut ftr Technologie (KIT), Germany

Reduced order modeling in fluid structure interaction via a POD-multiphase method
Erwan Liberge, LEPTIAB, Universite de La Rochelle, France
Aziz Hamdouni, LEPTIAB, Universite de La Rochelle, France

Benchmark of numerical codes for a coupled fluid-structure interaction computation of an elementary Vortex Induced Vibration case
Marie Pomarede, DCNS Propulsion, France
Jean-Francois Sigrist, DCNS Propulsion, France
Elisabeth Longatte, EDF R&D, France

Stability of rockfill dams by coupling the Discontinuous Deformation Analysis and the Finite Element Method
(1) S. Kaidi, (1) A. Ouahsine, (2) M. Rouainia, (3) F. Hissel (4) P. Coorevitz
(1) UTC, France, (2) Newcastle University, U.K (3) CETMEF, France, (4) LTI - IUT, France

18:00 Welcome Reception

Thursday 10 December 2009

09:00-10:30 Session 2.1 *Micromechanics*

Chair: H Iyama, Yatsushiro National College, Japan

Nonlinear Multiphysics Problems of Phase Transformations in Shape Memory Alloys and Finite Length Nanostructures

R.V.N. Melnik, M2NeT Lab, Wilfrid Laurier University, Canada
O.I. Tsviliuk, JSC RB, Ukraine
L.X. Wang, Hangzhou Dianzi University, P.R. China

Experimental and numerical study on penetration of micro/nano diamond particle into metal by underwater shock wave

Shigeru Tanaka: Faculty of engineering, Kumamoto University, Japan
Kazuyuki Hokamoto, Kumamoto University, Japan
Shigeru Itoh, Kumamoto University, Japan

Application of Response Surface Method to model static and dynamic properties of MEMS structure

Adam Martowicz, Andrzej Klepka, Tadeusz Uhl
AGH University of Science and Technology, Poland

Modeling of Coupled Surface and Drag Forces for the Transport and Capture

1.Farzam Javadpour, 2.Vahid Shabro, 3.Ayodeji Jeje, and 4.Carlos Torres-Verdin4
1,2 Jackson School of Geosciences, The University of Texas at Austin, USA
2,4 The University of Texas at Austin, USA
3 University of Calgary, Canada

Coupled Multiphysics Effects in Low Dimensional Nanostructures

R.V.N. Melnik, Wilfrid Laurier University, Canada
S.R. Sunil, Wilfrid Laurier University, Canada
O.I. Tsviliuk, JSC RB, Ukraine

10:30-11:00 Coffee Break

Thursday 11 December 2008

11:00-12:30 Session 2.2 *Impact and Explosions*

Chair: H. Naji, Universite Lille, France

Numerical analysis of the behavior of shock wave in spheroid vessel

Yosuke Nishimura, Naoki Kawaji Graduate school of Science and Technology, Kumamto University, Japan

Energy Absorption Capacity of Trailer Under-ride Guard

Basem Alzahabi, Department of Mechanical Engineering Kettering University, USA
Alan R. Goertz, M P Holcomb Engineering Corp, USA

On study of emulsification by the shock wave processing, and its variation with time

Ayumi Takemoto, Shigeru Itoh, Shockwave and Condesed Matter Reserach Center, Kumamoto University, Japan

The Numerical Analysis and Experiment of Shock Processing for Bouef

Y. Yamashita(1), A. Oda(1), H. Maehara(1), T. Hujii(1) M. Moatamedi(2) and S. Itoh(1)
(1)Kumamoto University, Japan (2) Narik University College, Norway

Numerical Simulation and Experiment for Underwater Shock Wave in Newly Designed Pressure Vessel

Manabu Shibuta, Hideki Hamashima, Shigeru Itoh, Kumamoto University, Japan

12:30-13:30 Lunch

Thursday 11 December 2008

13:30-15:00 Session 2.3 *Material Physics*

Chair: T Watanabe: National Fisheries University, Japan

Material Optimization of Carbon/Epoxy Composite Rotor for Spacecraft Energy Storage

Renuganth Varatharajoo, University Putra Malaysia, Malaysia.

Computation and control of the near-wake flow over a square cylinder with an upstream rod

H. Naji, Universite Lille 1 - Sciences et Technologies, France.

A. Mezrhab, Laboratoire de Mecanique & Energetique, Universite Mohamed 1, Maroc.

Study of Electrical conductivity in Fiber Composites

D. Mezdour(1, 2), S. Sahli(1), M.Tabellout (2)

1 Universite Mentouri de Constantine, Algerie

2 Universite du Maine, France

Finite Element Analysis of Human Femur

H. A. Khawaja_1, A. Naik_2, R. E. Cameron_3, K. Parvez_4

1, 2, 3. University of Cambridge, UK

4. National University of Sciences and Technology, Pakistan

The Dynamic Property of Aluminum Foam

Seiichi, Irie; Knnedy, Greg; Zoran, Ren; Shigeru, Itoh

University of Maribor, Slovenia

Kumamotot University, Japan

15:00-15:30 Tea Break

Thursday 11 December 2008

15:30-17:00 Session 2.4 *Modelling Advances*

Chair: DK McCluskey, University of Hertfordshire, UK

Switching between the Lagrangian and Eulerian solvers with the ExLO code

Minhyung Lee, Sejong University, Korea

Wan Jin Chung, Seoul National University of Technology, Korea

Simulation of an external vibroacoustic problem using boundary element method

Mohammed Amdi, Ahlem Alia, Mhamed Souli, University of Lille, France

A Hybrid Optimization Algorithm for Solving Global Optimization Problems

Leticia Velazquez (1), Carlos Quintero (2), Miguel Argaez (3), Hector Klie (4) and Mary Wheeler (5)

1, 2, 3. The University of Texas at El Paso, USA

4, 5. The University of Texas at Austin, USA

Natural Elements Method for Shallow Water Equations

Darbani. M., Ouahsine, A., Villon P,

Universite de Technologie de Compiegne, France

Advanced Simulation of Gas Meter Components

Muhammad Arsalan Farooq, S.M.Sohaib Tariq, Muhammad Faizan Mirza, Amir Naveed

NED University of Engineering and Technology, Pakistan

19:00 Conference Banquet

Friday 12 December 2008

09:00-10:30 Session 3.1 *New Applications*

Chair: Shigeru Itoh, *Kumamoto University, Japan*

Validation of normal and tangential force contact models for in contact spherical particles using FEM analysis

H. A. Khawaja, Department of Engineering, University of Cambridge, UK
S. A. Scott, Department of Engineering, University of Cambridge, UK
K. Parvez, Research Centre for Modelling and Simulation, National University of Sciences and Technology, Pakistan

End-of-pipe Challenges within Waste Management

Elisabeth Roman, Narvik University College, Norway

Prediction of Load-Displacement Curve for Weld-Bonded Stainless Steel Metal Using Finite Element Model

Essam A. Al-Bahkali, Jonny Herwan, King Saud University, Saudi Arabia

Pair Annihilation and Self Energy

Anamitra Palit, Private Tutor, Kolkata India

Why magnetic monopoles are not seen**?**

Siamak Khademi and Sadollah Nasiri
Department of Physics, Zanjan University, Iran

10:30-11:00 Coffee Break

Friday 12 December 2008

11:00-12:30 Session 3.2 ***Heat and Hydrodynamics***

Chair: Mhamed Souli, University of Lille, France

Study on Promotion of Evaporating Cryogenic Fluids by Direct Contacting Normal Temperature Fluids and Generation of Ice

Toshiaki Watanabe, National Fisheries University, Japan
Yuki Sato, National Fisheries University, Japan
Hironori Maehara: Kumamoto University, Japan
Shigeru Itoh, Kumamoto University, Japan

Behavior of bubble pulse in food processing using underwater shock wave

Hideki Hamashima, Kumamoto Industrial Research Institute, Japan
Manabu Shibuta, Kumamoto University, Japan
Yosuke Nishimura, Kumamoto University, Japan
Shigeru Itoh, Kumamoto University, Japan

A fast simulation and identification of hydrodynamic parameters for a freely maneuverings ship vessels

(1) Tran K.H., (1) Ouahsine A., (2) Naceur H., (3) Hissel F, (3) Pourplanche A..
(1) UTC, France
(2) UVHC, France
(3) CETMEF, France

Numerical simulation of droplet motion and two-phase flow field in an oscillating container

Tadashi Watanabe, Japan Atomic Energy Agency, Japan

Computation and control of the near-wake flow over a square cylinder with an upstream rod

H. Naji, Universite Lille 1, France.
A. Mezrhab, Universite Mohamed 1, Maroc.

12:30-13:30 Lunch

14:00 Close of Conference

SESSION 1.3

Keynote Address

WEDNESDAY 09 DECEMBER 2009
13:30 – 15:00

CHAIR

M Moatamedi
Narvik University College
Norway

Wednesday, 09 December 2009
13:30 – 15:00

Keynote Address

Multiphysics Challenges for Renewable Energy Devices

Professor Arne Erik Holdø
Vice Chancellor
Narvik University College
Norway

In recent years environmental issues due to man's activities have come into focus. One of the major concerns has been the present use of various types of fuels that are finite resources and which through chemical reactions give rise to gases which may have a harmful effect on our environment. Consequently, there has been a move towards developing technology that does not use fossil fuel or any other fuel of limited resource.
Renewable Energy' has taken on the meaning of all energy that is obtainable without using fossil fuel or any other fuel of limited resource. Many of the Renewable Energy technologies that are under current deployment and development have a Multiphysics base or vital components which are based on Multiphysics.
This presentation reviews the many Renewable Energy concepts and places them in their relevant developmental stages. Furthermore, the Multiphysics part of the concepts are studied and the challenges are examined both from a Multiphysics and a Numerical view point. Finally, an overall compilation of many of the Renewable Energy concepts and their numerical and modelling challenges are presented.

SESSION 1.4

FLUID STRUCTURE INTERACTION

WEDNESDAY 09 DECEMBER 2009
15:30 – 17:00

CHAIR

T Rahulan
Salford University
UK

ALE and FLUID-STRUCTURE INTERACTION
Applications For industrial problems

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Numerical problems due to element distortions limit the applicability of a Lagrangian description of motion when modeling large deformation processes.
An alternative technique is the multi-material Eulerian formulation. It is a method where the material flows through a mesh that is completely fixed in space and where each element is allowed to contain a mixture of different materials. The method completely avoids element distortions and it can, through an Eulerian-Lagrangian coupling algorithm, be combined with a Lagrangian description of motion for parts of the model.

The Eulerian formulation is not free from numerical problems. There are dissipation and dispersion problems associated with the flux of mass between elements. In addition, many elements might be needed for the Eulerian mesh to enclose the whole space where the material will be located during the simulated event.

This is where the multi-material arbitrary Lagrangian-Eulerian (ALE) formulation has its advantages. By translating, rotating and deforming the multi-material mesh in a controlled way, the mass flux between elements can be minimized and the mesh size can be kept smaller than in an Eulerian model.

Numerical investigations in mixed friction systems

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In the current context of global warming, improvements in energy saving are highly demanded. Friction effects occurring in mechanical systems are responsible for up to 10% loss of the overall worldwide produced energy and therefore need to be reduced. A numerical approach is here selected to investigate such effects. Analyses of friction behaviors in complex Elasto Hydrodynamic Lubrication systems are provided by this method. This is because testing rigs cannot be used or need complex adaptations to deliver reliable measurements. The following work focuses on the numerical investigations of mixed friction systems combining fluid-solid and solid-solid interactions at the micro scale. The goal is to improve the accuracy of macro models by applying more precise boundary conditions derived from micro models. A three dimensional model is built in a Finite Elements (FE) software. It is composed of one fluid lubricating two sliding rough surfaces. Both surfaces are generated according to a statistical method making use of measured technical surfaces. To model the interactions between the fluid and the solid structure, the Arbitrary-Lagrangian-Eulerian meshing process is utilized. Compared to the eulerian approach of conventional computational fluid dynamics, this technique offers the possibility to simulate contact domain topology changes occurring when two rough lubricated surfaces are sliding. The model is based on an axial floating bearing on which the adhesion effects are the most present. The main friction coefficient between both lubricated solids is established using the FE solver. Furthermore, solid-solid and fluid-solid friction can be separated from the global coefficient with further post-processing operations. Eventually, this study provides an approach how a numerical method can determine the behavior of a system submitted to mixed lubrication conditions.

Reduced order modeling in fluid structure interaction via a POD-multiphase method

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Erwan Liberge, LEPTIAB, universite de La Rochelle, France
Aziz Hamdouni, LEPTIAB, universite de La Rochelle, France

The reduced order modeling (ROM), in order to obtain a very low computational time, is an important field of computational mechanics. The best known method in fluid mechanics is the Proper Orthogonal Decomposition (POD) method which has been intensively used since the 1990's. The POD basis is then similar to the coherent structures of a turbulent fluid flow. In structure mechanics, there is no clear physical interpretation of the POD basis, but it appears that the POD method can be used as an efficient ROM tool. In fluid Structure Interaction (FSI), some methods have been developed (Lieu et al., 2006), (Liberge et al., 2008). The first reference proposes to take snapshots of the fluid velocity field on the moving grid of the FSI problem. The POD basis is also computed on a nodal (discrete) space, using the standard POD method, without any information on the position of the nodes. Next a low order dynamical system is obtained by the projection of the discretized linearized Navier-Stokes equations in ALE on the POD basis (Lieu et al., 2006). Liberge et al. (Liberge et al., 2008) proposed a POD-multiphasic formulation, valid for fluid rigid bodies interaction, taking into account the spatial information of the POD basis. The snapshots are computed using a classical ALE formulation for Fluid Structure Interaction problem and are interpolated from the time variant grid to a fixed grid, which contains all the moving mesh. The POD basis is computed for a global velocity field (fluid and structure) on the rigid grid. The basis do not show important differences, but in the last case it is not the Navier-Stokes equations in ALE which are projected, but the the multiphasic Navier-Stokes equations, the fluid and solid domain being considered as the same multiphasic domain. We propose in this paper a comparison between these methods in terms of computational time and accuracy.

Benchmark of numerical codes for a coupled fluid-structure interaction computation of an elementary Vortex Induced Vibration case

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Jean-Francois Sigrist, DCNS Propulsion, La Montagne, France
Elisabeth Longatte, EDF R&D, Chatou, France

Investigations of a CFD code called Code_Saturne and its propensity to reproduce the physical phenomenon called lock-in, which can appear during vortex induced vibrations of a single circular cylinder at low Reynolds number is proposed. The computational procedure relies on a partitioned method ensuring the coupling between fluid and structure solvers. Characteristic reduced magnitudes for this phenomenon are observed, as well as their influence on the response.

Keywords
Fluid-Structure Interaction, Vortex Induced Vibrations, Lock-in, Partitionned Procedure

Stability of rockfill dams by coupling the Discontinuous Deformation Analysis and the Finite Element Method

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This paper is concerned with fluid-structure coupling to study the stability of rockfill dams submitted to hydrodynamic waves and current actions. Rockfill dams are marine structures composed of an assemblage of superposed blocks. Usually, it used to protect littoral and harbours areas from the devastating attack of waves and currents, and also to protect flooding areas of the increased water level. The main purpose of this work is to study the stability and the resistance of these discrete structures. In the classical approach we used the so called Hudson formulation (1959) to estimate the stability coefficient of the dam. Elsewhere, this formulation depends only on weight blocks and of the dam slope but doesn't take account of contact between blocks. In the present work, in order to increase the lifespan of the dam, we take into account of the contact between blocks, as well as of their disposition and of their shape. Thence we performed a numerical study based on the fluid-structure interaction where we used the Finite Element Method for the fluid simulation and the Discontinuous Deformation Analysis (DDA) method to simulate the block's displacements. The DDA is an emerged method in the family of Discrete Element Methods (DEM), based on the minimization of the potential energy, used here to compute the simultaneous sliding and rotation of blocks. The blocks are modelled by simple polygons and no meshing is needed, where the augmented lagrangian technique is used to manage contacts between these rocks. The fluid model is based on the free surface shallow water equations, and is solved by Finite Element Method where the P1-P2 formulation is used for the numerical stability.

SESSION 2.1

MICROMECHANICS

THURSDAY 10 DECEMBER 2009
09:00 - 10:30

CHAIR

H Iyama, Yatsushiro
National College, Japan

Nonlinear Multiphysics Problems of Phase Transformations in Shape Memory Alloys and Finite Length Nanostructures

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L.X. Wang (Faculty of Mechanical Engineering, Hangzhou Dianzi University, Xiasha, Hangzhou, 310018, P.R. China)

Some of the most intriguing examples of multiphysics problems are brought about by smart materials and structures technologies where materials with shape memory effect found numerous applications at different spatial scales. In this contribution, we start from the general 3D model of dynamic nonlinear thermoelasticity, based on a coupled system of partial differential equations, which we first apply for the description of shape memory alloys (SMA) dynamics and associated phase transformations. First, we apply center-manifold-based reduction procedures allowing to construct systematically new simplified models preserving essential features of the SMA dynamics. For some special cases, the reduction procedure can be carried out with the Proper Orthogonal Decomposition (POD) methodology and we demonstrate this on an example. Then, our focus is on a mathematical model and its numerical discretization which we construct to analyze the wave propagation in shape memory alloy rods. From a mathematical point of view, the result is a system of coupled nonlinear time-dependent partial differential equations, known as the Ginzburg-Landau-Devonshire system. The effect of internal friction on wave propagation patterns is analyzed under shock loadings implemented via stress boundary conditions. For practical numerical simulations of SMA samples, the constructed model of coupled nonlinear system of PDEs is reduced to a system of differential-algebraic equations, where the Chebyshev collocation method is employed for the spatial discretization, while the backward differentiation is used for the integration in time.

Experimental and numerical study on penetration of micro/nano diamond particle into metal by underwater shock wave

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Shigeru Itoh:Shock Wave and Condensed Matter Research Center, Kumamoto University, 2-39-1 Kurokami, Kumamoto City, Kumamoto 860-8555, Japan

Recently there has been an effort in the development of new composite materials possessing combined properties of high heat conductivity and friction resistant. In this study developing a composite material with such properties using underwater shock wave was attempted. Underwater shock wave can be used to penetrate hard powders into a metal base without decomposition of the base material. In this method, hard powders are penetrated into a soft metal base to obtain a composite with improved surface properties. The purpose of this research is to clarify the experimental conditions for obtaining a new composite material with unique properties. Attempt has been made to obtain aluminum-based and magnesium alloy-based composites by introducing micro/nano-sized diamond particles to the surface of the base metal. Micro size man-made diamond particle is used for abrasive powder. The particle has sharp edges. On the other hand, Nano size diamond particle produced by explosion is spherical shape and those particles are aggregation. Micro diamond particles were stuck in metal surface, a lot of micro diamond particles were observed on the surface. A composite with rich diamond layer was recovered from experiment using micro diamond and aluminum but nano size diamond particle could not be stuck in metal surface and penetrated into metal base. There were no reactive products between diamond and metal from a result of X-ray diffraction on composite surface. Wear test was conducted to recovered samples, the friction resistance was improved due to micro diamond particles. Heat-transfer test was also conducted, heat characteristic was improved.

Application of Response Surface Method to model static and dynamic properties of MEMS structure

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Authors

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It is a common engineering practice to study behaviour of mechanical structures in terms of property changes of their models representing real variation present in physical constructions. This activity helps to find realistic assessment of scatters of both static and dynamic characteristics determined in virtual prototyping. However the inconvenience appears as needed number of necessary conducted iterations may grow significantly to fulfil requirements regarding reliability of nondeterministic calculations. Application of Response Surface Method may be a solution of mentioned problem. Present paper deals with metamodelling techniques utilized to speed up analyses of static and dynamic properties of selected MEMS structure. Microstructures are nowadays under significant development and the need of permanent improvement of their characteristics is observed. Manufacturing processes of MEMS structures feature variation of their characteristics which, in turn, results in variation of manufactured devices. Therefore determined scatters of properties help to assess quality of final product. In undertaken study chosen geometric imperfections as well as changes of material properties are considered. Performed computer simulations consider both mechanical and electrostatic characteristics of finite element model of analysed microstructure. Determined model is parameterized in order to study its characteristics in terms of given combinations of values of uncertain parameters. Results obtained for selected designs are used for the elaboration of metamodels. Elaborated approximations are finally used to perform uncertainty analysis to quantify the overall variation of studied properties.

Modeling of Coupled Surface and Drag Forces for the Transport and Capture

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We propose a mathematical model to study microparticle transport in porous media. Numerical porous media are constructed by packing spherical grains. Interstitial spaces in the porous beds are wide enough for microparticles to pass without steric hindrance. Particle retention is, therefore, a deep-bed filtration process. Interactive forces between the suspended particles flowing in the pore space as well as the stationary solid matrix determine the attachment and retention of the microparticles. Microparticle transport in porous media is modeled using a hierarchical set of differential equations corresponding to pore scale and macroscale. At the pore scale, movement and interaction of a single particle with a solid matrix is modeled using the advection-dispersion equation. A single microparticle entering the space encounters drag and surface forces. Drag forces are determined by solving the momentum equation in a unit cell composed of grains and interstitial space. Surface forces (electrostatic and van der Waals forces and fluid expression) between microparticles and grains are measured directly using an atomic force microscope (AFM). Measured surface forces appear as an additional force term in the velocity field equation of a microparticle in the interstitial space. These local events are then transformed into a macroscale continuum by imposing periodic boundary conditions for contiguous unit cells and using a scheme of moment analysis. At the macroscale, propagation and capture of particles are characterized by two position-independent coefficients: mean microparticle velocity vector U^* and mean microparticle retention rate constant k^*. Model results indicate that higher ratio of the particle diameter to average pore size increases particle retention. Decrease in advective velocity increases particle retention as well.

Coupled Multiphysics Effects in Low Dimensional Nanostructures

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In this presentation, we report the analysis of coupled multiphysics effects on properties of low dimensional semiconductor nanostructures (LDSNs), focusing on thermopiezoelectric and nonlinear electromechanical effects in quantum dots and nanowires. Our analysis is based on a coupled model of partial differential equations accounting for thermal, electric, and mechanical fields in a systematic manner. First, we investigate thermopiezoelectric field distributions and their effects on electronic properties of the highly strained CdTe/ZnTe quantum wires with the full 3D coupled thermoelectromechanical multiphysics formulation, consisting of balance equations for heat transfer, electrostatics and the mechanical field, developed by us earlier in [Phys. Status Solidi A, 206(5), 960-964, 2009]. We discuss the effects of thermal loadings on piezoelectric fields in CdTe/ZnTe quantum wire systems and quantify the conduction band edge shifts due to thermoelectromechancial loadings. Although for these particular systems, piezoelectric quantities are observed to be relatively less sensitive to thermal loadings, we demonstrate that the coupled effects are important in the determination of electronic/optoelectronic properties of such quantum wire systems. Next, we analyze GaN/AlN quantum dot systems of different geometries. We observe that GaN/AlN nanosystems are more sensitive to thermopiezoelectric effects than those of CdTe/ZnTe previously analyzed with the fully coupled multiphysics models. Earlier, in [Computers & Structures, 85 (11-14), 698-711, 2007], we demonstrate that the conventional application of linear models to the analysis of optoelectromechanical properties of nanostructures in bandstructure engineering could be inadequate.

SESSION 2.2

IMPACT AND EXPLOSIONS

THURSDAY 10 DECEMBER 2009
11:00 - 12:30

CHAIR

H Naji
University of Lille
France

Numerical analysis of the behavior of shock wave in spheroid vessel

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Food processing utilizing underwater shock wave softens the food by breaking cells, and prevents loss of nutrients since there is little influence of heat. Moreover, it is also possible to extract a nutrient easily and reduce processing time. A device to generate a high intensity shock wave is required in order to process various kinds of food. The purposes of this research are to investigate the best condition to generate high intensity shock waves and to understand the behavior of converged shock wave.

The capacitor electric discharge circuit was used as an underwater shock wave generating device. The pressure of shock wave and waveform of discharge voltage and current were measured in order to search for the best condition of underwater discharge. As a result it was confirmed that the ratio of discharge energy and charge energy (discharge efficiency) influenced the intensity of shock wave. In addition the pressure waveform of converged shock wave and non-converged shock wave were measured. The spheroid vessel was used to make the shock wave convergent after reflection, and the electrode and pressure sensor were set in two foci respectively. As a result partially negative pressure waveform was obtained when shock wave was made to convergent. Numerical analysis of converged shock wave was performed in order to check the propriety of those measurements.

Keywords
Shock wave, Underwater discharge, Convergent, Food processing

Energy Absorption Capacity of Trailer Under-ride Guard

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A trailer under-ride guard is usually designed to prevent or minimize the amount of under-ride a passenger vehicle striking the rear of the trailer will sustain. It is typically installed under the rear buck plate of the semi-trailer. The need for an under-ride prevention device is obvious when one realizes that the typical trailer deck is 40 inches above the ground and the car bumper is only 20 inches above the ground. The most common under-ride trailer guard consists of two vertical members supporting a horizontal member. The vertical members are designed to carry the loading in rear-to-front direction and may be reinforced sometimes by diagonal members. However, most current designs fold completely inward when the under-ride guards are struck with sufficient force. As the guard folds inward, it also pivots upward and eventually disengages from the striking vehicle allowing the vehicle to travel under the trailer, largely unimpeded, until the A-pillars of the passenger compartment are engaged. As such the vehicle occupants are at much greater risk of sustaining severe injuries. An improved design that is longitudinally offsets the horizontal bumper surface rearward with multiple load bearing supports is being proposed. The support extensions are designed to carry both axial and bending loads. It also allows the bumper to remain lower and engaged with the striking vehicle bumper as the verticals fold inward during the collision. After the vertical members are completely folded, the longitudinal support extensions will function as vertical support members for a second bumper for additional vehicle under-ride. This paper will present a comparative simulations study between both designs by examining the overall energy absorption capacity of both designs using LS-Dyna finite element analysis.

On study of emulsification by the shock wave processing, and its variation with time

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The shock wave transmitted at the speed that exceeds speed of sound generates the expansion wave by the density difference. Moreover, the sound wave velocity of the shock wave changes depending on the density difference. The shock wave is transmitted fast by the high density.Oil floats on water when water and oil are mixed, and the layer is formed. This is because the density of oil is lower than that of water. This density difference influences the sound wave velocity of the shock wave.Authors experimented on the shock wave load to the mixture of water and oil that formed the layer. The load of the shock wave has emulsified water and oil. This emulsification action is thought to be an influence into which the sound wave velocity of the shock wave changes. In addition, the particle distribution variation with time was investigated. In this research, the experiment result and the consideration are described.

Keywords
Shock Wave, Emulsifying, Agglomeration

The Numerical Analysis and Experiment of Shock Processing for Bouef

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When the shock wave processing is applied to food, it is understood to obtain the change in various physical properties. For instance, when hard beef is processed by the underwater shock wave, the tenderization of meat can be expected. In the future, it is a goal that the shock wave processor is spread in general as a home electrical appliance. In the design for the suitable pressure vessels for food processing, the phenomenon in pressure vessel are very complex in multi-physics manners. Therefore, in numerical calculation, a lot of parameter for the numerical analysis is need for pressure vessel material and various foods. In this study, we chose a beef as a sample of the food processing. First, we obtained an unknown parameter of the beef by measuring the front and the shock wave speed of the sample. Then, we will show some numerical results for shock loading of beef by using LS-DYNA3D. The experiments were carried out using the high-speed image converter camera, high-speed video camera and the explosive experimental facilities.

Keywords
Shock Wave, Food Processing, Numerical Analysis

Numerical Simulation and Experiment for Underwater Shock Wave in Newly Designed Pressure Vessel

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Modern eating habits depend in large part on the development of food processing technology. Thermal treatments are often performed in the conventional food processing, but it can cause discoloration and loss of nutrients of the food by thermal processing or treatment. On the other hand, food processing using an underwater shock wave has little influence of heat and its processing time is very short, preventing the loss of nutrients.

In this research optical observation experiment and the numerical simulation were performed, in order to understand and control the behavior of the underwater shock wave in the development of the processing container using an underwater shock wave for the factory and home. In this experiment a rectangular container was used to observe the behavior of the underwater shock wave. Polymethylmethacrylate (PMMA) was used for the observation, top and bottom side and Aluminum alloy were used for the wall side. This container is separated into two parts by a phosphor bronze plate. 0ne part is the shock wave generating container and the other is the food processing container. In the experiment, the shock wave was generated by using explosive on the shock wave generation side. The shock wave, which passed through the phosphor bronze and propagated from the aluminum wall, was observed on the processing container side. Numerical simulation of an analogous experimental model was investigated, where LS-DYNA software was used for the numerical simulation. The comparative study of the experiment and the numerical simulation was investigated. The behavior of a precursor shock wave from the device wall was able to be clarified.

Keywords
under water shock wave,

SESSION 2.3

MATERIAL PHYSICS

THURSDAY 10 DECEMBER 2009
13:30 – 15:00

CHAIR

Toshiaki Watanabe:
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Material Optimization of Carbon/Epoxy Composite Rotor for Spacecraft Energy Storage

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Flywheel technology is a promising technology for replacing the conventional battery as an energy storage device for spacecraft. The flywheels can also be simultaneously used for spacecraft attitude control. One of the key elements in flywheel energy storage system is the rotor inertia and the value of inertia is highly dependent on the rotor shape and material. An investigation to optimize the composite rotor is performed for the spacecraft energy storage application. A highspeed multilayer rotor design is proposed and different composite materials are tested to achieve the most suitable recipe. Finite element analysis is employed in the investigation in order to optimize the rotor. Subsequently, the modal analysis is carried out to determine the rotor natural frequencies and mode shapes for safe operational regimes below 50, 000 rpm.

Keywords
spacecraft flywheel, energy storage, finite element analysis

Computation and control of the near-wake flow over a square cylinder with an upstream rod

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The present work deals with the numerical simulation of channel flow with with a rod located upstream of a square cylinder in order to control the flow. Numerical investigations have been carried out using the Multiple Relaxation Time-Lattice Boltzmann Equation (MRT-LBE). To predict instantaneous behavior of the controlled flow, the dimensionless height of the rod is varied. Key computational issues involved are the computation of fluid forces acting on the square cylinder, the vortex shedding frequency and the impact of such bluff-body on the flow pattern. A particular attention is paid to drag and lift coefficients on the square cylinder. The predicted results from MRT-LBE simulations show that in most cases, the interaction was beneficial insofar the drag of the square block was lower with the rod than without it

Keywords
Flow control, drag and lift coefficients, multiple relaxation time, lattice Boltzmann equation

Study of Electrical conductivity in Fiber Composites

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Composite materials are commonly used in a wide variety of industrial applications such as pressure-sensing elements, resistors, transducers, thermistors, piezoresistors, chemical sensors and as packaging materials for substrates in electronic applications. Electrical conductive fibers provide the possibility to establish in polymer materials electrical conductivity and good mechanical properties simultaneously. The fibers orientation and length, their volume fraction and the fiber matrix adhesion can influence the electrical conductivity of the fiber composites [1,2]. In this study Three-dimensional simulations have been conducted to predict percolation threshold in fiber composite materials. A method is proposed to evaluate electrical resistance of fibrous composites. Assuming meandering paths, calculation is based on detecting conductive pathways through the insulating matrix. Percolation is detected by the height of the conducting cluster instead of its number at the two electrodes. The electrical resistivity and the conduction thresholds of the carbon fiber reinforced polycarbonate composites have been characterized. It has been shown that conduction threshold decreases when decreasing the thickness z of the samples. Decreasing the percolation threshold with longer fibre and random orientation has been also verified. Lower percolation thresholds were obtained with fibres of aspect ratio AR equal to 20. Simulation results are in good agreement with an experimental study result found in the literature [3] (Fig. 1).

Keywords
Composites, Electrical resistance, Fibers, Polymer- matrix, Simulation

Finite Element Analysis of Human Femur

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An effort has been made to analyze the stresses experienced by the human femur. In order to achieve these results, a CAD model is developed by the 3-D scanning of generic human femur for an individual of 70kg weight (approx. averaged adult weight). The marrow cavity has been approximated as a hollow cylinder. The FEM model is built using solid tetrahedral element (20-noded 186 structural solid, ANSYS?). The model is analyzed for its grid sensitivity. Based on major functionality of femur, isotropic material model is considered instead of anisotropic. The results are computed for the range of loads. In this analysis, the maximum stress and its location are noted. In addition, the critical value of load is estimated for ultimate failure (i.e. fracture). The evaluated results give an understanding of the natural safety factor. These results are also of great importance in order to replicate the natural design parameters in creating the synthetic bone substitute.

Keywords
FEM, Human Femur, Solid Tetrahedral Element

The Dynamic Property of Aluminum Foam

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Aluminum in the foam of metallic foam is in the early stage of industrialization. It has various beneficial characteristics such as being lightweight, heat resistance, and an electromagnetic radiation shield. Therefore, the use of aluminium foam is expected to reduce the weight of equipment for transportation such as the car, trains, and aircraft. The use as energy absorption material is examined. Moreover aluminum foam can absorb the shock wave, and decrease the shock of the blast. Many researchers have reported about aluminum foam, but only a little information is available for high strain rates (103s-1 or more). Therefore, the aluminum foam at high strain rates hasn?ft been not characterized yet. The purpose in this research is to evaluate the behavior of the aluminum form in the high-strain rate. In this paper, the collision test on high strain rate of the aluminum foam is investigated. After experiment, the numerical analysis model will be made. In this experiment, a powder gun was used to generate the high strain rate in aluminum foam. In-situ PVDF gauges were used for measuring pressure and the length of effectiveness that acts on the aluminum foam. The aluminum foam was accelerated to about 400m/s and 200m/s from deflagration of single component powder and the foam were made to collide with the PVDF gauge. The high strain rate deformation of the aluminum form was measured at two collision speeds. As for the result of both speed, pressure was observed to go up rapidly when about 70% was compressed. From this result, it is understood that complete crush of the cell is caused when the relative volume is about 70%. In the next stage, this data will be compared with the numerical analysis.

Keywords
Aluminum foam, high strain rate, powder gun, PVDF gauge, numerical analysis

SESSION 2.4

MODELLING ADVANCES

THURSDAY 10 DECEMBER 2009
15:30 – 17:00

CHAIR

DK McCluskey
Coventry University
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Switching between the Lagrangian and Eulerian solvers with the ExLO code

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Recently we developed a three-dimensional FEM hydrocode, ExLO, in which the Lagrangian and Eulerian solvers are integrated into a single framework. In this paper a methodology for the solver switching during the calculation is discussed. This method is particularly efficient for large deformation problems in which material undergoes severe mesh distortion. In this case, simulation of all the processes with a single solver scheme may not be efficient. In this paper, solver switching method has been discussed for better simulations for the shaped-charge projectiles.

Keywords
Solver switching, ExLO, hydrocode, shaped charge

Simulation of an external vibroacoustic problem using boundary element method

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In this work, boundary element method is used to simulate the external acoustic radiation in a vibroacoustic problem. The structure is simulated using finite element method in time domain. The FFT allows to transform the mechanical response to the frequency domain. This one is used as a boundary condition for the acoustic problem which is solved with BEM.

Keywords
bem, acoustic, external radiation

A Hybrid Optimization Algorithm for Solving Global Optimization Problems

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Finding a global optimal solution is a challenging task in many environmental applications that estimate subsurface parameters since the data and models are usually nonlinear and subject to different sources of error. Moreover, in many cases the number of these parameters may be significantly large since they generally depend on a prescribed level of spatial and temporal resolution. Many of these problems are computationally demanding, and have motivated the necessity for developing novel optimization approaches. In this paper, we implement a hybrid optimization approach that is based on the coupling of the Simultaneous Perturbation Stochastic Approximation (SPSA) and Newton-Krylov Interior-Point (NKIP) algorithms. First, we use SPSA to explore the parameter space by starting with different initial guesses, and conjecture region(s) where a global solution may be located. Then we select the target region with the lowest function values and ﬁlter the data by eliminating the information outside the selected target region by using a predened radius. Using the selected data inside the target region, we create a quadratic or cubic surrogate model that provides us with a smooth approximation of the objective function and allow us to compute derivative information. Later, some inequality constraints are added to the model that correspond to physical properties of the problem. Finally, the NKIP algorithm is applied to the constrained surrogate model for obtaining the solution of the problem. We present some numerical results on a set of very small problems and two medium to large-scale applications from reservoir simulations.

Keywords

Global optimization, Hybrid Methods, Reservoir Simulations.

Natural Elements Method for Shallow Water Equations

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Free surface flows are often simulated in shallow water approximation using Eulerian descriptions. However, numerical instabilities arise in simulating some phenomena such as breaking waves or strong varying slop of the bathymetry...etc. These phenomena may give rise to strong gradients and lead to large distortion of grids meshes. Hence classical Finite Elements Methods may fall in simulating such problems. In this paper we present a meshless method, based on the Natural Element Method (NEM). In a geometrical domain of points cloud, NEM uses the Voronoi cells and then its dual, namely Delaunay triangulation. Its main advantage lies in shape function of the natural neighbour interpolation, such that the position of natural neighbours is enough to its construction. To avoid the calculation of nonlinear terms, the time material derivative term is descretesized by Lagrangian procedure. We also use an appropriate nodal integration technique to estimate integrals related to the diffusion, pressure and Coriolis terms because in NEM shape functions are rational. For the diffusion term, the Stabilized Conforming Nodal Integration method (SCNI) is proposed, while for pressure and Coriolis terms a geometrical method is used to switch the integration over the cells domain to the integration over the edges. The method was successfully used to simulate dam-break flows by solving the fully 2D Shallow Water Equations (SWE) by using an implicit scheme under a transient flow.

Keywords
NEM, SWE, Voronoi, free surface, nodal Integration

Advanced Simulation of Gas Meter Components

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Gas meter has been modeled through many different simulation techniques in the recent times, suggesting new solution and giving new ways to minimize the material cost. In this project we will present an advanced simulation of the gas meter components, taking into account the maximum tensile strength and structural integrity. Our design presents a basic gas meter model to predict the behavior of structures while that it can withstand external & internal forces. After a finite element model is prepared and checked, boundary conditions applied, and the model is solved, it is time to investigate the results of the analysis. Batch process will be used for the solution, in batch processing governing equations are assembled into matrix form and are numerically solved.The assembly process depends on the types of analysis, model?s element types, material properties and boundary conditions. Those points will be identified which are exceeding the limits of maximum tensile strength of the material.The result show clear picture of the Von-Mises stresses, Strain, displacement and deformation. This research paper will assist other projects, like ensuring the structural integrity and minimizing the material cost of automobile and aircraft designs. It also focuses on the shorter lead time of the delivery of product.

Keywords
Simulation, Boundary Conditions, Von Mises Stresses, Structural Integrity.

SESSION 3.1

<u>NEW APPLICATIONS</u>

FRIDAY 11 DECEMBER 2009
09:00 – 10:30

CHAIR

S Itoh
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Japan

Validation of normal and tangential force contact models for in contact spherical particles using FEM analysis

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An effort was made to compute the contact forces between 2 spheres, including contact pressure (normal) and frictional stress (tangential) using FEM. A CAD model of a part of a sphere was developed. A mesh was created using ANSYS? Solid 186, 20-Noded Hexahedral Element and analyzed for its sensitivity. For evaluation of contact forces, ANSYS ?Contact 174 and Target 170, 8-Noded surface elements were used. Contact pressure and frictional stress contours were calculated by varying the displacements. Normal and Tangential contact forces were computed by integrating contact pressure and frictional stress over the contact surface. Also it was ensured that internal stresses were lower than the plastic deformation limit of the material. The values obtained for normal force were compared with the non-linear spring model as given by Hertz [1]. The results were found to be in agreement with the model. Similarly values of tangential force were compared with the Mindlin and Deresiewicz (MD) [2] model, which is a non-linear spring model that varies with load history. The results of the tangential force compared favourably with the MD model. 1. HERTZ, H. (1882). Journal der rennin und angewandeten Mathematik, 92, 136. 2. MINDLIN, R. (1953). Journal of Applied Mechanics, 20, 327.

Keywords
FEM, Sphere, Contact Forces, Contact Pressure, Contact Frictional Stress

End-of-pipe Challenges within Waste Management

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The implementation of EU Waste Directive in Norway in 2003 has led to stricter regulations of leachate and gas emissions from landfills. Specific guidelines on leachate monitoring and risk assessment for emissions from landfills were published in 2005. First of July 2009 a total veto was introduced for putting degradable waste on landfill. This reflects the Norwegian Governments strategy to manage the waste by reuse and recycling since landfilling is regarded as non-sustainable waste treatment method. The authorities in Norway have made restrictions towards landfill owners in order to control diffuse spread of leachate into groundwater in 2005. Autumn 2009, they also have demanded landfills with proper marine recipients to clean their leachate before July 2011. These decisions covers however only landfills under operation. Most of the landfills operated 20 years ago, are terminated. However, leachate from these landfills, are still escaping untreated and, represent an environmental problem for the recipient. In Norway, marine ecosystems along the coastline are recipient for most of the landfills terminated or still in operation. The actual knowledge and competence about the waste chain from product in use, via waste product, put on landfill and to end-of-pipe pollution - covers a broad field of competence. Landfill processes include a complex set of chemical reactions and microbial anaerobic processes. The pollution product at end-of-pipe is in fact a ?finger-print? of the actual product put on landfill. Leachate characterisation demands competence of how different waste fractions decompose inside the landfill. The design of a monitoring system to control diffuse spread of leachate into soil and ground water demands geological competence. When leachate mixes with for example marine recipient along the Norwegian coastline, a new set of competence come into use. This includes knowledge of how the marine recipient stands this pollution. This implies knowledge of dilution, streams, tides, precipitation of heavy metals and sedimentation.

Prediction of Load-Displacement Curve for Weld-Bonded Stainless Steel Metal Using Finite Element Model

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Resistance Spot Welding (RSW) has been used for many years as a sheet metal joining process in automotive, aerospace, home appliance and other industries. It has been widely used because it is easy to operate and control, thus an ideal joining technology for mass production. Weld-bonded is a combination of the conventional resistance spot welding and adhesive-bonding, which has gathered wide acceptance as an effective joining process for significant improvement in static, dynamic and impact toughness properties of sheet metal joints. It also improves the corrosion, noise resistance and stiffness of the joint, over those observed in conventional resistance spot welding. In order to get the effective mechanical properties of resistance spot welding, the effect of welding current, welding time, and applied load were studied, the electrode force and the welding current had the significant effect to the maximum tensile shear strength. Getting a representative model of weld-bonded metals is very important for further design of joining. In this work, finite element method will be used to get a representative model and fit the load displacement curve with the experimental data to evaluate the model?s accuracy. The ductile fracture limit criteria were developed to predict the deformation and fracture initiation of the model. Detailed material properties of each zone of resistance spot welding (nugget, heat affected zone, and base metal) are essential to accurately simulate the model. Reverse engineering analysis will be introduced to get those material properties by modeling the indentation process using finite element software, and conduct some iteration of models until the load-displacement curve of indentation agree with the experimental curve.

Pair Annihilation and Self Energy

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Electrostatic self energy has always been a problem of perplexing magnitude. Matters become more complicated when we try to view the problem of pair annihilation in relation to self energy in the light of the classical laws. Where does the self energy go to when pair annihilation takes place? The field theories try to solve this problem intelligently with the help of the virtual photons. The interaction between the charged particle and the virtual photons creates self energy which is taken care of by the Feynman-Diagrams. But is this representation accurate enough to replace the classical self energy in all its totality? Is it at all possible to explain the self energy problem with the classical laws? Such matters have been investigated in this article.

Keywords
Pair Annihilation, Self-Energy, Uncertainty relation, Electron-Positron Dipole

Why magnetic monopoles are not seen?

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Although one finds many important results, like electric charge quantization, from the existence of magnetic monopoles, but many efforts for detection and measurement of magnetic monopoles are not succeeded until now.. In this paper the electric charge quantization is obtained form the gauge invariance of the normalization of distribution functions in phase space. So by a comparison between our and Dirac?s electric charge quantization, one finds the quantum uncertainty relation as a reason for the invisibility of magnetic monopoles

Keywords
magnetic monopoles- Quantization- Charge- Phase space-

SESSION 3.2

HEAT AND HYDRODYNAMICS

FRIDAY 11 DECEMBER 2009
11:00 – 12:30

CHAIR

M Souli
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Study on Promotion of Evaporating Cryogenic Fluids by Direct Contacting Normal Temperature Fluids and Generation of Ice

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The mixture of the extreme low temperature fluid and the normal temperature fluid becomes the cause which causes pressure vessel and piping system crush due to explosive boiling and rapid freezing. In recent years in Japan, the demand of cryogenic fluids like a LH2, LNG is increasing because of the advance of fuel cell device technology, hydrogen of engine, and stream of consciousness for environmental agreement. These fuel liquids are cryogenic fluids. Cryogenic fluids have characteristics such as thermal stratification and flashing by pressure release in storage vessel. On the other hand, as for fisheries as well, the use of a source of energy that environment load is small has been being a pressing need. And, the need of the ice is high, as before, for keeping freshness of marine products in fisheries. Therefore, we carried out the experiments related to promotion of evaporating cryogenic fluids and generation of ice, in the contact directly of the water and liquid nitrogen.

Keywords

Cryogenic Fluid, Evaporating, Ice Generation

Behavior of bubble pulse in food processing using underwater shock wave

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The food processing technology using a shock wave can prevent deterioration of the food by heat because it can process food in a short time. However, in order to process safely, it is important to clarify the behavior of the shock wave because the action to the food by a shock wave is complicated. In this research, in order to investigate the behavior of the shock wave in the container used for food processing, the optical observation experiment and the numerical simulation were performed. In the experiment, the shock wave generated by explosion was observed with the high-speed video camera. The numerical simulation about the behavior of shock wave was performed using analysis software LS-DYNA. Comparing and examining were performed about the experimental result and the numerical simulation result. It was confirmed that the behavior about the shock wave generated by explosion and the shock wave generated by bubble pulse of the explosion gas.

Keywords
Underwater shock wave, bubble pulse, Food processing

A fast simulation and identification of hydrodynamic parameters for a freely maneuverings ship vessels

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The frequency of ship groundings and collisions led to study and modelize the various factors involved during the course of a maneuvering ship [1]. Among these factors there are the ship characteristics (the hull force, rudder force, propeller force...), the site configuration (depth, distances to bank), the hydrodynamic conditions (wind, currents, surge, etc.) [2-4]. This study deals with an approach for the identification of maneuvering coefficients for a self-propelled ship. We present a numerical procedure based on the coupling of an optimization technique and a mechanical model of the ship hydrodynamic and paths equations. The main objective is to simulate ship trajectories by adjusting some coefficients that have some special features, to estimate motion variables, hydrodynamic force, and the speed and the direction of current. To better identify ship hydrodynamics coefficients than what has been suggested in the literature [5, 6], we propose an automatic approach based on two steps, first a sensitivity analysis is carried out to identify most sensitive parameters, then a second optimization procedure is launched to identify the sensitive parameters, that yields specific maneuvers well known among pilots and naval architects. The numerical procedure has been applied for the identification of hydrodynamics coefficients of two ships for automatic path controlling maneuverability. The simulation results are presented and compared to experimental trajectories using sensors installed on the ship for tests taken real steps to follow paths; the comparison shows the effectiveness of the proposed approach aiming in to be robust.

Numerical simulation of droplet motion and two-phase flow field in an oscillating container

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A levitated liquid droplet is used to measure material properties of molten metal at high temperature, since the effect of container wall is eliminated for precise measurement. The levitation of liquid droplet is controlled by using electrostatic, magnetic or ultrasonic force in the vertical direction, and rotation around the levitation axis, which is used to stabilize the droplet, is controlled by the acoustic force perpendicular to the axis. It is thus important to know the behaviour of droplet in an oscillating flow field. The streaming flows associated with ultrasonic levitator have been studied experimentally and theoretically. Although flows in and around the droplet were studied, the dynamic motion of the droplet in the oscillating flow field has not yet been discussed well. The motion of the droplet and the flow field around the droplet in an oscillating container are simulated numerically in this study as a fluid-structure interaction problem. Incompressible Navier-Stokes equations are solved using the level set method. In the level set method, the level set function, which is the distance function from the two-phase interface, is calculated by solving the transport equation. The effect of compressibility is taken into account as the density perturbation. The oscillating container is modeled using the ALE method, where the computational grid points are moved with the container speed. It is found that flows from the droplet surface to the container wall appear in the oscillating direction. The droplet is shown to move toward the pressure node against the induced flow field and to locate there stably. The induced flow field is found to be similar to the flow field around an oscillating droplet in a static container. The effect of compressibility on the droplet motion and the flow field is also discussed.

Keywords
Two-phase flow, droplet, interface, oscillation, fluid-structure interaction

Computation and control of the near-wake flow over a square cylinder with an upstream rod

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The present work deals with the numerical simulation of channel flow with with a rod located upstream of a square cylinder in order to control the flow. Numerical investigations have been carried out using the Multiple Relaxation Time-Lattice Boltzmann Equation (MRT-LBE). To predict instantaneous behavior of the controlled flow, the dimensionless height of the rod is varied. Key computational issues involved are the computation of fluid forces acting on the square cylinder, the vortex shedding frequency and the impact of such bluff-body on the flow pattern. A particular attention is paid to drag and lift coefficients on the square cylinder. The predicted results from MRT-LBE simulations show that in most cases, the interaction was beneficial insofar the drag of the square block was lower with the rod than without it

Keywords
Flow control, drag and lift coefficients, multiple relaxation time, lattice Boltzmann equation

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