Editors

Petr Mastny
Valeriy Perminov

Advances in Fluid Mechanics & Heat & Mass Transfer

- Proceedings of the 10th WSEAS International Conference on Heat Transfer, Thermal Engineering and Environment (HTE '12)
- Proceedings of the 10th WSEAS International Conference on Fluid Mechanics & Aerodynamics (FMA '12)

Istanbul, Turkey, August 21-23, 2012

Recent Advances in Mechanical Engineering Series | 1

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Preface

This year the 10th WSEAS International Conference on Heat Transfer, Thermal Engineering and Environment (HTE '12) and the 10th WSEAS International Conference on Fluid Mechanics & Aerodynamics (FMA '12) were held in Istanbul, Turkey, August 21-23, 2012. The conferences provided a platform to discuss heat and mass transfer, internal combustion engines, steam generators, turbulent heat transfer, urban air pollution, environmental protection, solar energy, waste management, alternative fuels, biofluids, ocean engineering, turbulence etc. with participants from all over the world, both from academia and from industry.

Their success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of these conferences are published in this Book that will be sent to international indexes. They will be also available in the E-Library of the WSEAS. Extended versions of the best papers will be promoted to many Journals for further evaluation.

Conferences such as these can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Plenary Lecture 1

Mathematics Methods Usage for Diagnostic and Early Forecast of Emergency for Metallurgical Installations Refractory Linings

Dr. Andrew Zabolotsky
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Abstract: Refractory lining damage fixing is a complicated task, because of high temperature usage of installation and various characters of possible lining damages. So, only damages, which have connections with working surface of the lining, could be fixed directly. Such dangerous damages as metal penetration between working and control layer of the installation of thin inner cracks are invisible for visual methods of control, laser scanning of the surface for example. But all these damages have some temperature effects on the outer surface of the metal casing of the installation. This temperature effect can be fixed with up-to-date measurement equipment and the obtained data is enough for fixing and characterization of the damage. A Complex of mathematics and physics methods (such as FEM, Relaxation, heat likeness and so on) is needed for transformation of the outer temperature field of installation into the 3-dimentional damage map of the lining. This Complex was successfully applied for heat transfer modeling and damage fixing for such equipment as casting ladle, RH-degasser and VD-VOD degasser.

Brief Biography of the Speaker: Andrew V. Zabolotsky was born in St. Petersburg, Russia in 1975. He had graduated from St. Petersburg State Institute of Technology (Technical University), department of High-Temperature Materials in 1998. He had defended a thesis about technology of silicon nitride ceramics and received PhD degree in technical sciences in 2002. After graduating he worked at JSK “Sigma-T” (2000-2002) – a producer of high-temperature testing equipment for ceramics and refractory materials as a head of heat insulation department. Between 2002 and 2004 he was a technologist at laboratory of “Refractory materials ltd.”, a company which produced refractory concrete for iron and steel industry. At the present time he is an engineer-technologist of “Magnezit Group ltd.” – one of the main producers of periclasse-carbon refractory materials in Russia and Europe. He had prepared about 20 papers for different journals in Russia and other countries (mostly between 2009 and 2011). He was a participant of several international conferences (for example IAS Conference in 2009 at Buenos Aires, Argentina, WSEAS Conference in Puerto de la Cruze, Spain in 2010). He is WSEAS (since 2010) and AIST (Association of Iron and Steel Technology) member since 2011. At the present time he is working with problems of heat exchange in refractory linings of metallurgical installations and using of mathematics methods for emergency forecasting in metallurgy.

Plenary Lecture 2

Studies and Researches Regarding the Performance of a New Model of Vertical Wind Rotor Turbine for Small Power

Assoc. Prof. Badea Lepadatescu
Transilvania University of Brasov
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Abstract: In the paper are shown the recent researches regarding the performance of a new vertical wind turbine rotor that we want to propose for the next wind turbine with small power. We started our researches to a small scale wind rotor vertical position and after the test results we designed and realized a new wind turbine rotor with a special shape that were tested in real conditions to find his performance. After that we sent this rotor to a big university in U.S.A. to make the tests in an aerodynamic tunnel. These test results are now shown in the paper.

Brief Biography of the Speaker: Badea Lepadatescu is currently an Associate Professor at the Faculty of Technological Engineering and Industrial Management of Transylvania University of Brasov, Romania. He obtained his doctoral degree in 1998 in the area of machining through superfinishing process. After he graduated he worked five years as design engineer at Roman truck factory in the field of manufacturing processes where he designed many devices and special machine tools especially for superfinishing process. Started on 1982 he worked as research engineer at Transilvania University of Brasov, and after 1997 he is teaching at Department of Manufacturing Engineering. His main academic interests include Tolerance and Dimensional Control, Manufacturing Engineering Processes, Automation Processes, and Renewable Energy Sources. The research accomplishments are reflected through publications in a five books and authored or co-authored over 120 papers published at international conferences. He has extensive experience in both experimental and theoretical research work having more than 50 contracts with factories to design and produce machine tools for machining processes. Also in the field of Renewable Energy Sources together with a team he made two wind turbines, one with horizontal axis for taking water, and one with vertical axis to produce electric energy. He has been speaker to international conferences, has moderated forums, organized symposia, workshops and sessions at major international conferences.

Plenary Lecture 3

Renovation of Dwellings in Flanders: Towards the Development of a Durable Solution for the Energy Problems in Flanders

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Abstract: In 2007, the European Union (EU) issued its 20/20/20-targets for 2020. By means of this policy, the EU aims at setting targets in the area of climate change, external energy dependence, and a sustainable, continuous energy supply. In general, the energy performance of buildings is an important aspect in European energy and climate policy. Within this framework, the Flemish government has developed the “Energy Performance and Interior Climate” policy (or EPB standard) and the “Energy Renovation Program 2020”. These programs aim at a removal of ‘energy-swallowing’ dwellings from the Flemish dwelling stock by 2020. The goal of this paper is to contribute to the development of a durable solution for the energy problems in Flanders (Belgium). Therefore, our approach will focus on the energy-related, the practical, and the economic aspects of the problem. We start with four existing dwellings from consecutive time periods. These dwellings are subject to renovation of their structural elements as well as of their HVAC (heating, ventilation, and air conditioning) system. The energy performance of the structural elements is improved by insulating them up to the level of the EPB standard and the standard of low-energy buildings. Subsequently, different HVAC systems are compared. The energy efficiency of the measures is evaluated using the EPB software. The practical side of the research relates to controlling the physical properties of the building and an evaluation of the practical consequences of the renovations. To examine the economic aspect of the measures, we carry out a cost analysis and an evaluation of the investments. The investment evaluation takes into account both individual measures and combined measures. The evaluation reveals which measures and combined measures are the most advantageous.

Brief Biography of the Speaker: Amaryllis Audenaert is co-dean of the faculty of Applied Engineering at the University of Antwerp and head of education applied engineering: construction at the Artesis University College of Antwerp. Her area of expertise is the economic and ecological impact of energy measures in buildings. The research incorporates the laws of building physics to describe the energetic behaviour of buildings and combines these fundamentals of heat, air and moisture with the thermal comfort of the habitants. She authored or co-authored many scientific papers published in reviewed journals or presented at international conferences.

Plenary Lecture 4

Process of Electrospinning with an Emphasis to the Rheological Behaviour of PVB Solutions

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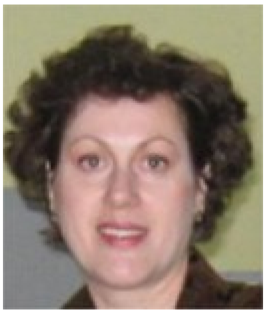
Abstract: The process of electrospinning is a low-cost procedure that creates nanofibres through an electrically charged jet of polymer solution or polymer melt. Electrospinning process consists schematically of a pipette holding the polymer solution, two electrodes, a DC voltage supply in the kV range, and a grounded collector. The high voltage causes drawing of the polymer drop from the tip of the pipette into a fibre. The electrically charged jets are collected as a web of fibres on the surface of a grounded collector. By virtue of their high surface-to-volume ratio, the electrospun nanofibre sheets are used as protective clothing and filtration, tissue scaffolding and other biomedical applications, reinforcement in composites, and optical, electronic and high performance applications. The emphasis will be paid to correlation between electrorheological behaviour of various polyvinylbutyral (PVB) solutions and quality of the corresponding nanofibre webs.

Brief Biography of the Speaker: Petr Filip graduated from the Charles University in Prague, Faculty of Mathematics and Physics, Czech Republic in 1976. He completed his Ph.D. study at the Institute of Mathematics, Acad. Sci. Czech Rep., his Ph.D. Thesis was devoted to oscillatory solutions of partial differential equations. Since 1980 he has been with the Institute of Hydrodynamics, Acad. Sci. Czech Rep., Prague, for many years as a head of the Department of Chemical Engineering where he was interested in fluid mechanics, especially theory of jets and mixing. Later on he was appointed to the position of a scientific secretary (up to now), at present his sphere of interest is rheology (flow of non-Newtonian liquids). He is an author (co-author) of more than 100 contributions published in international journals and conference proceedings.

Plenary Lecture 5

Optimum Tilt Angle for Solar Collectors with Low Concentration Ratio



Associate Professor Krisztina Uzuneanu
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Abstract: The conversion of renewable energies become more important day by day, because of the conventional fuels cost and the environmental pollution. Solar energy is one of these renewable energies which can be converted directly into electricity or into heat. The efficiency of solar collector depends on many factors: design, construction, position, orientation, climatic condition of the place, application for they are used. The best way to collect maximum solar energy is to optimize the position and orientation of solar collectors. The performance of any solar energy system depends very much on the availability of solar radiation and the orientation of solar collectors. Solar collectors need to be inclined at the optimum angle to maximize the receiving energy. In this work, we proposed to analyze the optimum tilt angle for compound parabolic collectors CPC with different concentration ratios. There are analyzed the energy gains when the collector keeps the same position during the whole year and when the collector changes it tilt twice a year, on summer and on winter.

Brief Biography of the Speaker: Dr. Krisztina Uzuneanu graduated Faculty of Mechanical Engineering of University "Dunarea de Jos" of Galati in 1984 and she obtained the title of Doctor Engineer in 1998. Since 1987 she followed the academic carrier at Dunarea de Jos University of Galati as assistant, lecturer and associate professor. Dr. Uzuneanu is a visiting professor at different universities: Universidade do Minho, Portugal, Universita degli Studi di Genova, Italy, Universita degli Studi di Salerno, Italy, Pannon University Veszprem, Hungary, Erciyes University Kayseri, Turkey and visitor scientist of of Universidade do Minho Guimaraes, Portugal where she was awarded with a post-doc NATO grant in 2002 - 2003. Research fields are connected with applied thermodynamics, alternative fuels for internal combustion engines, modeling the thermal stresses of different parts of internal combustion engines, renewable energy and pollution. Dr. Uzuneanu published over 100 articles in national and internationals conferences proceedings and she is author of 3 books. The research work was done as member of 20 research contracts financed by European Commission and Romanian Ministry of Education and Research and director of 5 research contracts financed by industry. Dr. K. Uzuneanu is member of Romanian Society of Thermodynamics since 1990 and member of Balkan Environmental Association since 2011.

Plenary Lecture 6

Ethanol–Methanol Blends in Gasoline Engine

Professor Charalampos Arapatsakos
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Abstract: The use of ethanol and methanol as fuels can contribute to the decrease of photochemical smog since it does not produces hydrocarbons. Vehicles that burn petroleum fuels produce carbon monoxide (CO) because these fuels do not contain oxygen in their molecular structure. Carbon monoxide is a toxic gas that is formed by incomplete combustion. When ethanol and methanol, which contains oxygen, is mixed with gasoline the combustion of the engine is more complete and the result is CO reduction. Using renewable fuels, such as ethanol, there is also a reduction of carbon dioxide (CO2) in the atmosphere. Carbon dioxide is non-toxic but contributes to the greenhouse effect. Because of the fact that plants absorb carbon dioxide and give off oxygen, the amount of CO2 that is formed during combustion is balanced by that absorbed by plants used to produce ethanol. That is why the use of ethanol and methanol will partially offset the greenhouse effect that is formed by carbon dioxide emissions of burning gasoline. This work examines the behavior of a small four-stroke engine when mixtures of gasoline-ethanol and gasoline-methanol are used as fuels.

Brief Biography of the Speaker: Dr. Charalampos Arapatsakos is a Greek citizen, who has been born in Athens. He has studied Mechanical of Engineering. He is Professor on Democritus University of Thrace in Greece. Prof C. Arapatsakos has participated in many research programs about biofuels, gas emissions and antipollution technology. His research domains are mainly on biofuels and their use in internal combustion engines, the power variation from the use of biofuels, the gas emissions and mechanical damages.

Plenary Lecture 7

Nonlinear Buoyant Flow during the Solidification of Binary and Ternary Alloys

Professor Daniel N. Riahi
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USA
also with:
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Abstract: In this lecture we first review the problems of nonlinear buoyant convective flow during the solidification of binary and ternary alloys that have been investigated in the last two decades. Next, we consider the recent modeling efforts and studies of such flows with and without presence of special effects that can help to understand such flows and can be used, in particular, for flow control purposes to reduce tendency for the chimney formation within the mushy layers. The chimneys produce undesirable freckles in the final form of the solidified alloys, which are imperfections that reduce the quality of the material. Methods of control aim at eliminating the convective flow in the chimneys also serve to eliminate the presence of chimneys thereby result in producing higher quality crystals. Using both analytical and numerical methods, we determine the solutions for the nonlinear problems in a range of either one effective Rayleigh number in the binary alloy case or two effective Rayleigh numbers in the ternary alloy case and near the onset of motion. We present the results and compare with the available experimental evidence. We also explain extension of present studies to related interesting problems that can be investigated in future.

Brief Biography of the Speaker: Daniel N. Riahi served as Full Professor at The University of Illinois at Urbana-Champaign (UIUC) from 1995 to 2005, as Professor Emeritus at UIUC since 2005 with the home Dept of Mechanical Science and Eng (MechSE), and as Full Professor in the Dept of Math at University of Texas-Pan American since 2006. Dr. Riahi's research work & interest include studies in convection, flow instabilities & turbulence, flow during solidification & crystal growth, electromagnetic applications, and math modeling and theoretical developments with applications to eng and physical sciences. His research accomplishments include new theories and a number of discoveries in fundamental areas of convective and shear flows, some of which were already confirmed by the experimental studies. Professor Riahi received Appreciation Letters, Service Recognition Award & Certificates, Honorific Title Award & Research Awards from UIUC. He is member of over seven professional societies and a Fellow of Wessex Institute of Great Britain. He is author of Chapters in a book that won the Best Basic Science Book-Award by IAA. He was awarded NSF Grants, UIUC-RB & UTPA-FRC Grants, NCSA Awards and supervised NASA Sponsored Res. Projects. He presented many Invited Lectures and several Plenary Lectures at National & International Conferences. He is Editor and Editorial Board Member of over 20 technical journals and book series. He is author of over 330 publications mostly published in rigorously refereed journals, including books, invited articles, review articles and chapters of books.

Plenary Lecture 8

Density-Based Numerical Methods for Cavitating Flow

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Dept. of Mechanical Engineering
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Abstract: Numerical methods for gas-liquid multi-phase flow such as cavitating flow with variable density are discussed. Cavitation is well known phase change phenomenon encountered in the flow of hydraulic machine systems. When cavitation occurs and collapses near solid surfaces, it causes the noise, vibration and damage to the systems. In the sense of reducing these unfavorable effects and understanding the behavior of collapsing of cavitation bubbles, some efforts to propose cavity flow model for numerical simulations and, analytical and experimental method for shock-bubble interaction problems have been made. Recently, the author has proposed a mathematical cavity flow model based on a homogeneous model and numerical method for cavitating flow. This method employs a finite-difference Runge-Kutta method and Roe's flux difference splitting approximation with the MUSCL-TVD scheme. The homogeneous equilibrium gas-liquid multi-phase model taken account of the compressibility of mixed media is applied. Therefore, the present density-based numerical method permits simple treatment of the whole gas-liquid mixed flow field, including wave propagation, large density changes and incompressible flow characteristics at low Mach number. In this lecture, above mentioned numerical methods for cavitating flow are introduced and discussed. From the computational results, complicated cavity flow phenomena, bubble collapsing behavior, shock-bubble interaction and shock transmission/reflection phenomena are investigated.

Brief Biography of the Speaker: Prof. Byeong Rog Shin received his Ph.D. degree in Mechanical Engineering from Tohoku University, Sendai, Japan, in 1991. He served as Associate Professor at Tohoku University from 1997-2004. He is currently a Professor in the Department of Mechanical Engineering, Changwon National University, Changwon, Korea. His research interests are in the areas of CFD to develop numerical schemes for the compressible/incompressible viscous flows and the gas-liquid two-phase flows, as well as in the areas of the numerical simulation for the prediction, optimal design and the improvement of the performance of turbomachinery systems. He is author and co-author of 4 books related CFD and engineering mathematics. Professor Shin received National Prize of Korea from Korean Government in 2002, Best Paper Awards from Turbomachinery Society of Japan in 2001 and Korean Fluid Machinery Association in 2011. He is member of ten professional societies and Co-Editor and Editorial Board Member of several technical journals.

Plenary Lecture 9

Large Eddy Simulation of Flow over a Twisted Elliptic Cylinder at a Subcritical Reynolds Number

Professor Hyun Sik Yoon
Global Core Research Center for Ships and Offshore Plants
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Abstract: The wavy cylinder has a sinusoidal variation in cross sectional area along the spanwise direction and the torsional cylinder has been newly designed by rotating the elliptic cross section along the spanwise direction, so that the cylinder surface has a twisted spiral pattern. For an ellipse, different eccentricities are considered to observe the effect of eccentricity on the flow fields. It guarantees the accuracy of the present numerical methods that the excellent comparisons with previous studies for the cases of a smooth circular cylinder and a wavy cylinder. The effect of surface torsion which is newly designed in here has been predicted and assessed in terms of the mean drag and root-mean-square (RMS) value of fluctuating lift in the subcritical Reynolds number range. Subsequently, the mechanisms of enhancing the aerodynamic performance and passive control of vortex-induced vibrations are also investigated by careful analysis with the flow structures. The isosurface of swirling strength has been imposed to identify the vortical structures in the turbulent wake.

Brief Biography of the Speaker: Hyun Sik Yoon holds a position of Associate Professor in Global Core Research Center for Ships and Offshore Plants at Pusan National University in the Korea. His research interests include flow control, heat and mixing enhancement, flow-structure interaction and biomimetics. He has authored over 100 publications in refereed journals and refereed proceedings of international conferences. He is also the recipient of numerous research grants from the National Science Foundation (NSF), other funding agencies as well as academic awards.

Plenary Lecture 10

Deep Insight into the still Hidden Theory of Isoenergetic Flow (Part Two)

Dr. Richard Selescu
Trisonic Wind Tunnel Laboratory
Experimental Aerodynamics Compartment, Flow Physics Department
"Elie Carafoli" National Institute for Aerospace Research
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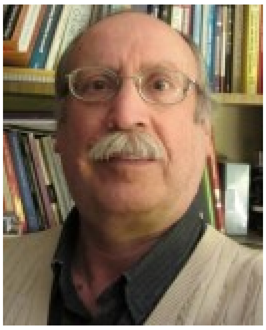
Abstract: This work studies and clarifies some local physical phenomena in fluid mechanics, in the form of an intrinsic analytic study, regarding the motion, continuity, flow rate and velocity potential equations (for inviscid compressible fluids), and the vortex equation (for viscous incompressible fluids), and finds new first integrals. It continues a series of works presented at some conferences and at a congress during 2008 – 2010, representing a real deep insight into the still hidden theory of isoenergetic flow (a real "physiology of the fluid medium"). Several new functions, surfaces and vectors were introduced: the polytropic integral surfaces, for the motion equation; Selescu's incompressible roto-viscous vector, for the vortex equation; the 2-D "quasi-stream" function on the 3-D (V, Ω) surfaces, for the continuity equation; the surfaces of iso-normal mass flux density (over which the continuity equation of the steady flow of a compressible fluid in a thick stream tube admits a first integral – the same as for this flow in a thin tube, and whose envelope sheets are just the sections of uniform flow, if they exist), for the flow rate equation; the 3-D stream function vector, allowing new local and global forms for the continuity equation; Selescu's "quasi-incompressible quasi-potential" (Laplace) lines of a "quasi-uniform" rotational flow of an inviscid compressible fluid, for the velocity (quasi-)potential equation (Steichen). A case of first integrability for the system of equations (motion and continuity) for the steady flow of an inviscid compressible fluid was also considered.

Brief Biography of the Speaker: Senior researcher Richard Selescu graduated as an engineer from the Polytechnic Institute of Bucharest, the Faculty of Mechanics, Department of Aircraft Engineering in 1970. He is working at the National Institute for Aerospace Research "Elie Carafoli'' – INCAS, Department of Aerodynamics, at the Trisonic Wind Tunnel Laboratory. He received his PhD degree in Aerodynamics and Fluid Mechanics at the Aerospace Engineering Faculty of the "Politehnica" University of Bucharest in 1999. Among the research fields of interest, he approached the analytic modeling in aerodynamics, fluid mechanics and magnetofluid dynamics. Thus, he introduced the following nomenclature: the isentropic surfaces and a 2-D velocity quasi-potential function on these surfaces (in fluid mechanics); the zero-work surfaces for the non-conservative terms in the motion equation (in viscous fluid mechanics and magnetofluid dynamics); some new physical quantities – the roto-viscous vector (in Newtonian viscous fluid mechanics), the incompressible roto-viscous vector (in viscous incompressible fluid mechanics, for the vortex equation), the magneto-hydrodynamic vector (in inviscid magnetofluid dynamics), the roto-visco-magnetic vector (in viscous magnetofluid dynamics) and the magnetic vector (in visco-magnetic magnetofluid dynamics, for the equation of magnetic induction); a new shock-free axisymmetric supersonic flow – the tronconical flow (in supersonic aerogasdynamics); the similarity depth for satisfying the gas-hydrodynamic analogy (in supercritical hydrodynamics). The newest introduced nomenclature is not mentioned.

Plenary Lecture 11

Euler, Navier-Stokes, and Modified Equations of Motion and Their Connections to Schrödinger and Dirac Wave Equations of Quantum Mechanics



Professor Siavash H. Sohrab
Robert McCormick School of Engineering and Applied Science
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Abstract: After the introduction of a scale invariant model of statistical mechanics, the exact relations between Euler, Navier-Stokes, and a modified form of equations of motions are described and their connections to Schrödinger and Dirac wave equations of quantum mechanics are discussed. The quantum mechanical foundation of the problem of turbulence is described and the phenomenon of turbulent dissipation in general and the role of Heisenberg spectral kinematic viscosity in such dissipation processes are examined. Also, the central role of vorticity in turbulent dissipation based on a modified form of Helmholtz vorticity equation is discussed. Finally, the scale invariant nature of Reynolds stresses are described and their role in the closure problem of turbulence are addressed.

Brief Biography of the Speaker: Siavash H. Sohrab received his PhD in Engineering Physics in 1981 from University of California, San Diego, his MS degree in Mechanical Engineering from San Jose State University in 1975, and his BS degree in Mechanical Engineering from the University of California, Davis in 1973. He joined Northwestern University in 1982 and since 1990 he is Associate Professor of Mechanical Engineering at the Northwestern University.

Plenary Lecture 12

Analytical Methods for Leak and Blockage Detection in Pipelines

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Abstract: Different methods for leak and blockage detection are proposed in the literature. Solution of a complicated inverse problem is required in order to find the location and magnitude of the leak (or blockage). For a real water distribution system the solution depends on many factors (for example, the age of the system, unknown friction factors and diameters of pipes, the number of segments in the system). In some cases, however, analytical approach to the solution of the problem of leak and blockage detection is possible. The method can be used for a single pipeline. The idea of the method is as follows. A small transient is generated in a pipleline. A linearized equation for unsteady pressure perturbation is solved analytically using the method of the Laplace transform. The solution is obtained in the form of a Fourier series with respect to the longitudinal coordinate. The coefficients of the Fourier series are functions of time. The damping rates of different harmonic components of the solution can be represented as the sum of a steady state friction damping factor and leak-induced (or blockage-induced) damping factor. In general, the leak-induced or blockage-induced damping factors can be calculated as the roots of a transcendental equation. However, for the case of small leak discharge or small blockage resistance parameter a simple formula can be derived which relates the location of the leak (or blockage) with the ratio of two damping rates of leak-induced (or blockage-induced) damping factor. The method is generalized for a finite number of leaks (or blockages). Limitations of the proposed model are discussed.

Brief Biography of the Speaker: Andrei Kolyshkin received his undergraduate degree in Applied Mathematics in 1976 at the Riga Technical University. In 1981 he received a Ph.D in differential equations and mathematical physics at the University of St. Petersburg (Russia). Andrei Kolyshkin is currently a full professor at the Department of Engineering Mathematics at the Riga Technical University. His current research interests include investigation of stability problems in fluid mechanics with applications to open-channel flows, transient flows in hydraulic systems and mathematical models for eddy current testing. He is the co-author of three monographs published by Academic Press and CRM. Andrei Kolyshkin has participated in more than 40 international conferences and has published more than 70 papers in refereed journals since 1980. As a visiting professor and visiting researcher he spent a few years at the University of Ottawa and Hong Kong University of Science and Technology.

Plenary Lecture 13

Experiment and Performance Prediction of Bubble-Jet Type Air-Lift Pump for Dredging Sediments on Sea and Lake Beads

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Abstract: The bubble-jet-type air-lift pump was invented by Sadatomi in order to dredging sediments deposited on sea and lake beds by striking water jet with air bubbles. In the present paper, the performance of the pump has been reported. In the experiments, 50 mm I.D. and 5.0 m long pipe was used as an upriser of the pump. The test sediments were three kinds of spherical particles of different size and density, while the test liquid was 3.0 wt % saltwater in view of the usage in sea. The submergence ratio i.e., the ratio of the upriser length submerged in water to the total upriser length, was changed from 0.76 to 0.84, and the air supply rate to the upriser was changed up to 250 l/min while the water rate to the bubble-jet-generator was fixed at 72.0 l/min. In the analysis, Yoshinaga et al.'s model for predicting discharge rates of water and particles was modified by incorporating a correlation of particles flow rate fraction in water-particles mixture. The modified model could predict well the present data at an efficient pump operation condition irrespective of the differences in the salinity, the particles specifications and the submergence ratio.

Brief Biography of the Speaker: Michio Sadatomi graduated from Kumamoto University, Japan in 1974, and took Doctor of Engineering from Kyushu University in 1986. He became an Associate Professor of Kumamoto University in 1988, and studied at University of Toronto, Canada, as an International Fellowship Researcher in 1990-91, and became a Professor of Kumamoto University in 1998. His specialty is mechanics of fluids, especially thermal hydraulics of multiphase systems. He became a Fellow of the Japan Society for Mechanical Engineering in 2007, and worked as the Lead Organizer of 12th International Symposium on Gas-Liquid Two-Phase Flows in ASME-JSME-KSME Joint Fluids Engineering Conference in 2011. Now, he works as the Chair of 6th Japanese-European Two-Phase Flow Group Meeting (November 23-27/2012) and as the President of the Japanese Society for Multiphase Flow.

Plenary Lecture 14

Experimental Diagnosis of Various Biofluid Flow Phenomena

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Abstract: Biological flows are vital for the conservation of life and indispensable commodity of living organisms. Morphological structures of living organisms and biological flow phenomena in nature have been evolved through long history. The basic physics of several biofluid flow phenomena and the hidden secrets of nature such as blood flow in chicken embryos, blood sucking of mosquitoes, and sap flows in plants have been investigated experimentally using advanced flow visualization techniques (X-ray PIV, holographic PTV, time-resolved micro-PIV etc). The biological samples include insects (blood-sucking of mosquitoes, digestive system of butterflies), fishes (zebra fish, planktons), animals (blood flows in chicken embryos or rats) and plants (sap flow in xylem vessels of rice or Arabidopsis). Moreover, gold nanoparticles (AuNPs) were employed as tracer particles to measure instantaneous velocity fields of bio-fluid flows. The developed AuNPs particles transmit the membranes of organisms without destroying the surrounding tissues. Detailed understanding on these biofluid flow phenomena will be used to develop creative biomimic technologies for practical applications in bio-medical science, microfluidics and renewable energy etc.

Brief Biography of the Speaker: Sang Joon Lee: He received his MSc and Ph.D. from Dept. of Mechanical Eng. of KAIST(Korea Advanced Institute of Sci. & Tech.) in 1982 and 1986, respectively. In 1986, he worked as a senior researcher at KIMM. He joined the Dept. of Mechanical Eng. at POSTECH as an assistant professor in 1987 January and he became a full professor in 1999. He was selected as a POSTECH fellow on 2010. His laboratory was designated as a National Research Lab. on 2000 and CRI (Creative Research Initiatives) centre on 2010 by Korea government. His research interests include biofluid flow and biomimetics, microfluidics, flow control and advanced flow visualization.