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OCTOBER 8-10 2009, BOSTON, MA, USA

welcome

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The COMSOL Conference 2009 Boston was held on October 8-10, 2009. This event gathered engineers from a broad spectrum of industries to unveil state-of-the-art achievements in multiphysics simulation.

Conference Highlights

Keynote Talks

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COMSOL CONFERENCE 2009

OCTOBER 8-10 2009, BOSTON, MA, USA

october 8-10

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User Presentations

User Talks

Thursday, October 8

Friday, October 9

Poster Session

User Talks

Thursday, October 8

Multiphysics I
Thursday, October 8, 2:30pm - 4:00pm
Moderator: Glenn Gomes, Atomic Energy of Canada Ltd.

Importance of Assembly Discontinuity Factors In Simulating Reactor Cores Containing Highly Heterogeneous Fuel Assemblies

G. Gomes[1]
[1] Atomic Energy of Canada Limited, Mississuaga, Ontario, Canada

Multi-Scale Modelling of Catalytic Microreactors

C. Theodoropoulos[1] , and B. Hari[1]
[1] The University of Manchester, School of Chemical Engineering and Analytical Science, Manchester, UK

Two-dimensional Analysis of Triple Coupled Physics of Structural Mechanics, Diffusion and Heat Transfer in a Gas Pipe

P. Lee-Sullivan[1] , and M. Haghighi-Yazdi[1]
[1] Department of Mechanical and Mechatronics Engineering, University of Waterloo,Waterloo, Ontario, Canada

Magneto-hydrodynamic Flow in Electrolyte Solutions

M. Qin[1] , and H. Bau[1]
[1] Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, Pennsylvania, USA

The Role of COMSOL Toward a Low-Enriched Uranium Fuel Design for the High Flux Isotope Reactor

J.D. Freels[1]
[1] Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA

Expanding Your Materials Horizons

R. Pryor[1]
[1] Pryor Knowledge Systems, Inc. (COMSOL Certified Consultant), Bloomfield Hills, Michigan, USA

Optimization and Inverse Methods
Thursday, October 8, 2:30pm - 4:00pm
Moderator: Robert Spilker, Rennselaer Polytechnic Institute

Multiphysics Topology Optimization of Heat Transfer and Fluid Flow Systems

E. Dede[1]
[1] Toyota Research Institute of North America, Ann Arbor, Michigan, USA

Design and Optimization of an All Optically Driven Phase Correction MEMS Deformable Mirror Device using Finite Element Analysis

V. Mathur[1] , K. Anglin[1] , V.S. Prasher[1] , K. Termkoa[1] , S.R. Vangala[1] , X. Qian[1] , J. Sherwood[1] , W.D. Goodhue[1] , B. Haji-Saeed[2] , and J. Khoury[2]
[1] Photonics Center, University of Massachusetts-Lowell, Lowell, Massachusetts, USA
[2] Air Force Research Laboratory/Sensors Directorate, Hanscom Air Force Base, Massachusetts, USA

Optimization of Carbon Nanotube Field Emission Arrays

B. L. Crossley[1] , M. Kossler[1] , P.J. Collins[1] , R. A. Coutu, Jr.[1] , and L. A. Starman[1]
[1] Air Force Institute of Technology, Wright-Patterson AFB, Ohio, USA

Modeling of Shrinkage Behavior in Cement Paste Using Thermal-structural Interaction

Tzu-Chau Chen[1] , and P.G. Ifju[1]
[1] University of Florida, Gainesville, Florida, USA

Estimation of Boundary Properties Using Stochastic Differential Equations and COMSOL

A. Atalla[1] , and A. Jeremic[1]
[1] McMaster University, Hamilton, Ontario, Canada

Semiconductors & MEMS
Thursday, October 8, 2:30pm - 4:00pm
Moderator: Casey Ladtkow, Covidien

A Study of Lubricating Flows in MEMS Bearings

E. Gutierrez-Miravete[1] , and J. Streeter[2]
[1] Department of Engineering and Science, Rensselaer at Hartford, Hartford, Connecticut, USA
[2] Optiwind, Torrington, Connecticut, USA

Three-Dimensional Simulation of Signal Generation in Wide-Bandgap Semiconductor Radiation Detectors

J. E. Toney[1]
[1] Pennsylvania State University Electro-Optics Center, Freeport, Pennsylvania, USA

The Fabrication of a New Actuator Based on the Flexoelectric Effect

S. Baskaran[1] , S. Thiruvannamalai[1] , N. Ramachandran[1] , F.M. Sebastian[1] , and J.Y. Fu[1]
[1] State University of New York at Buffalo, Buffalo, New York, USA

Multiphysics Simulation of the Effect of Sensing and Spacer Layers on SAW Velocity

P. Zheng[1,4] , D.W. Greve[2,4] , and I.J. Oppenheim[3,4]
[1] Department of Physics, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA
[2] Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA
[3] Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA
[4] National Energy Technology Laboratory, Pittsburgh, Pennsylvania, USA

Quasi-TEM Analysis of Multiconductor Transmission Lines Embedded in Layered Dielectric Region

S.M. Musa[1] , and M.N.O. Sadiku[1]
[1] Prairie View A&M University Networking Academy, Prairie View, Texas, USA

Transport Phenomena I
Thursday, October 8, 2:30pm - 4:00pm
Moderator: Daniel Burns, Massachusetts Institute of Technology

Multiphase, Dual Polymer Injection Molding and Cooling of an Open Cavity to Form both Distinct and Graduated Material Properties within a Complex Three-Dimensional Body

M.S. Yeoman[1]
[1] Continuum Blue Ltd, Forest Row, United Kingdom

Model-Based Calibration System for Direct Thermal Printing

W. Vetterling[1] , and Z. Peng[1]
[1] Zink Imaging, Inc., Bedford, Massachusetts, USA

COMSOL Multiphysics for Efficient Solution of a Transient Reaction-Diffusion System with Fast Reaction

M.K. Gobbert[1] , A. Churchill[1] , G. Wang[1] , and T.I. Seidman[1]
[1] Department of Mathematics and Statistics, University of Maryland, Baltimore County, Baltimore, Maryland, USA

A Moisture Transfer Model for Drying of Grain

K. Lund[1]
[1] Kurt Lund Consulting, Del Mar, California, USA

Study of Hydrogen Release from a Metal Hydride Bed

K. Song[1] , and H. Knickle[1]
[1] Department of Chemical Engineering, University of Rhode Island, Kingston Rhode Island, USA

Modeling the chloride-induced corrosion initiation of steel rebar in concrete

P. Ghods[1] , K. Karadakis[1] , O. B. Isgor[1] , and G. McRae[1]
[1] Carleton University, Ottawa, Ontario, Canada

Friday, October 9

Electromagnetics I

Friday, October 9, 8:30am - 10:00am
Moderator: John Blottman, Naval Undersea Warfare Center

MultiPhysics Analysis of Trapped Field in Multi-Layer YBCO Plates

P. Masson[1] , and R. Meinke[1]
[1] Advanced Magnet Lab, Palm Bay, Florida, USA

Numerical Study of the Electrical Properties of Insulating Thin Films Deposited on a Conductive Substrate

R.A.Gerhardt[1] , and S. Kumar[1]
[1] School of Materials Science and Engineering, Georgia Institute of Technology, Atlanta, Georgia, USA

Analysis of Transient Electromagnetic Dipole

J.C. Crompton[1] , K.C. Koppenhoefer[1] , and S.Y. Yushanov[1]
[1] AltaSim Technologies, LLC, Columbus, Ohio, USA

Wireless Interaction of Neighboring Two Arm Archimedes Spiral Coils in the RF Electromagnet Range

A. Kalinowski[1]
[1] Naval Undersea Warfare Center/ Division Newport, Newport, RI, USA

Effect of Antennae Polarization Relative to Tunnel Orientation on Electromagnetic Wave Scattering due to Underground Tunnels

A. Farid[1] , and T. Raza[1]
[1] Civil Engineering, Boise State University, Boise, Idaho, USA

Development of an On-Line Wall-Fouling Sensor for Pipeline Transportation of Heavy Oil-Water Mixtures

S. Rushd[1] , and R.S. Sanders[1]
[1] Chemical & Materials Engineering Department, University of Alberta, Edmonton, AB, Canada

Numerical Methods & Education

Friday, October 9, 8:30am - 10:00am
Moderator: William P. Winfree, NASA Langley Research Center

Parallel Performance Studies for COMSOL Multiphysics Using Scripting and Batch Processing

N. Petra[1] , and M.K. Gobbert[1]
[1] Department of Mathematics and Statistics, University of Maryland, Baltimore County, Baltimore, Maryland, USA

Benchmark Comparison of Natural Convection in a Tall Cavity

H. Dillon[1]
[1] Department of Mechanical Engineering, University of Washington, Seattle, Washington, USA

COMSOL in the Academic Environment at USNA

K. Mcilhany[1] , and R. Malek-Madani[2]
[1] Department of Physics U. S. Naval Academy, Annapolis, Maryland, USA
[2] Department of Mathematics, U. S. Naval Academy, Annapolis, Maryland, USA

Design of Graphical User Interfaces for Teaching Microchemical Systems Modeling Principles to Chemical Engineering Students

P.L. Mills[1] , S. Seelam[1] , and A. Nagaraj[2]
[1] Department of Chemical and Natural Gas Engineering, Texas A&M University-Kingsville, Kingsville, Texas, USA
[2] Department of Environmental Engineering, Texas A&M University-Kingsville, Kingsville, Texas, USA

Finite Element Analysis of Molecular Rydberg States

M.G. Levy[1] , X. Liang[1] , R.M. Stratt[1] , and P.M. Weber[1]
[1] Department of Chemistry, Brown University, Providence, Rhode Island, USA

Modeling the Bacterial Clearance in Capillary Network Using Coupled Stochastic-Differential and Navier-Stokes Equations

A. Atalla[1] , and A. Jeremic[1]
[1] McMaster University, Hamilton, Ontario, Canada

Fluid Dynamics
Friday, October 9, 8:30am - 10:00am
Moderator: Ranjith Divigalpitiya, 3M Canada Company

Collection efficiency of particles on a ribbon in a turbulent air flow

R. Divigalpitiya[1]
[1] 3M Canada Company, London, Ontario, Canada

An Analysis of Skimboard Hydrodynamics

N.D. Barnett[1] , and E. Gutirrez-Miravete[2]
[1] General Dynamics-Electric Boat, Kingston, Rhode Island, USA
[2] Rensselaer at Hartford, Hartford, Connecticut, USA

Mixing Layer Analysis in Variable Density Turbulent Flow

A.E. Alshayji[1]
[1] Department of Mechanical Engineering, College of Engineering and Petroleum, Kuwait University, Safat, Kuwait

Flow and Mixing in the Liquid between Bubbles

B. Finlayson[1]
[1] Department of Chemical Engineering, University of Washington, Seattle, Washington, USA

Simulation of the Turbulent Flow in HEV Static Mixers : Mixing of Ethanol with Gasoline

A. Eissa[1]
[1] Department of Chemical Engineering, Cairo University, Giza, Egypt

Structural Mechanics & Acoustics
Friday, October 9, 8:30am - 10:00am
Moderator: Julie Slaughter, Etrema Products, Inc.

Coupled Structural and Magnetic Models: Linear Magnetostriction in COMSOL

J. Slaughter[1]
[1] Etrema Products, Inc., Ames, Iowa, USA

Computing Surface Acoustic Wave Dispersion and Band Gaps

R. Westafer[1] , S. Mohammadi[1] , A. Adibi[1] , and W. Hunt[1]
[1] School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Georgia, USA

Analysis of the Acoustic Response of a Railroad Bridge

K. Koppenhoefer[1] , S.Yushanov[1] , and M.H. McKenna[2]
[1] AltaSim Technologies, LLC, Columbus, Ohio, USA

[2] U.S. Army Engineering Research and Development Center

Coupled Models of Lithospheric Flexure and Magma Chamber Pressurization at Large Volcanoes on Venus

G. Galgana[1] , P. McGovern[2] , and E. Grosfils[2]
[1] Lunar and Planetary Institute, Houston, Texas, USA
[2] Pomona College, Claremont, California, USA

Modeling the response of photoacoustic gas sensors

S.L. Firebaugh[1] , F. Roignant[2] , and E.A. Terray[3]
[1] United States Naval Academy, Annapolis, Maryland, USA
[2] Polytechnique Nantes, Nantes, France
[3] Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA

The Origin of Mass-change Sensitivity within Multi-layered, Non-uniform, Piezoelectrically-actuated Millimeter-sized Cantilever (PEMC) Biosensors: Vibrational Analysis through Experiment and Finite Element Modeling (FEM)

B.N. Johnson[1] , and R. Mutharasan[1]
[1] Department of Chemical and Biological Engineering, Drexel University, Philadelphia, Pennsylvania, USA

Electromagnetics II
Friday, October 9, 1:30pm - 3:00pm
Moderator: Giorgio Bonmassar, Harvard Medical School, Massachusetts General Hospital

Designing Polymer Thick Film Intracranial Electrodes for use in Intra-Operative MRI Setting.

G. Bonmassar[1] , and A. Golby[2]
[1] AA. Martinos Center, Massachusetts General Hospital, Charlestown, Massachusetts, USA
[2] Department of Neurosurgery, Brigham and Women's Hospital, Boston, Massachusetts, USA

Analysis of Forces acting on Superparamagnetic beads in fluid medium in Gradient Magnetic Fields

U. Veeramachaneni[1] , and R.L. Carroll[1]
[1] Department of Chemistry, West Virginia University, Morgantown, West Virginia, USA

Designing a Current Injection Tool for Logging While Drilling

B. Oetiker[1] , B. Friedman[1] , and H.E. Hall Jr.[1]
[1] Department of Physics, Sam Houston State University, Huntsville, Texas, USA

Finite Element Modeling of Transient Eddy Currents in Multilayer Aluminum Structures

V. Babbar[1] , and T. Krause[1]
[1] Department of Physics, Royal Military College of Canada, Kingston, Ontario, Canada

Fast Computation of Capacitance Matrix and Potential Distribution for Multiconductor in Non-Homogenous Multilayered Dielectric Media

S.M. Musa[1] , and M.N.O. Sadiku[1]
[1] Prairie View A&M University Networking Academy, Prairie View, Texas, USA

Modeling a 3D Eddy Current Problem Using the Weak Formulation of the Convective A-phi Steady State Method

J. Bird[1]
[1] University of North Carolina, Charlotte, North Carolina, USA

Batteries and Fuel Cells
Friday, October 9, 1:30pm - 3:00pm
Moderator: Ralph White, University of South Carolina

Mathematical Modeling of a Lithium Ion Battery

R. E. White[1] , and Long Cai[2]
[1] R.E. White & Associates LLC, Columbia, South Carolina, USA
[2] Department of Chemical Engineering, University of South Carolina, Columbia, South Carolina, USA

Numerical and Experimental Study of Flow, Heat Transfer and Concentration in a Scaled-up Fuel Cell Anode Channel Model

J. C. Torchia-Nüñez[1] , and J.G. Cervantes-de-Gortari[1]
[1] Department of Thermal Engineering, National University of Mexico, UNAM, Mexico City, Mexico

Modeling Hydrogen Permeation through a Thin TiO2 Film Deposited on Pd

Z. Qin[1] , Y. Zeng[1] , and D.W. Shoesmith[1]
[1] The University of Western Ontario, London, Ontario, Canada

Numerical Study of Microfluidic Fuel Cell Performance

A. E. Khabbazi[1] , A.J. Richards[1] , and M. Hoorfar[1]
[1] School of Engineering, UBC Okanagan, Kelowna, BC Canada, Canada

Finite Element Analysis of an Enzymatic Biofuel Cell: The Orientations of a chip inside a blood artery

C. Wang[1] , Y. Parikh[1] , Y. Song[1] , and J. Yang[1]
[1] Mechanical & Materials Science Engineering, Florida International University, Miami, Florida, USA

Bioengineering
Friday, October 9, 1:30pm - 3:00pm
Moderator: Ed Furlani, University at Buffalo

Full-Wave Simulation of an Optofluidic Transmission-Mode Biosensor

E. P. Furlani[1] , N. M. Litchinitse[2] , and R. Biswas[2]
[1] The Institute for Lasers, Photonics and Biophotonics, University at Buffalo, Buffalo, New York, USA
[2] Department of Electrical Engineering, The State University of New York at Buffalo,Buffalo, New York, USA

An Efficient Finite Element Analysis on an RF Structure Used to Evaluate the Effect of Microwave Radiation on Uveal Melanoma Cells

A. Dulipovici[1] , D. Roman[2] , I. Stiharu[2] , and V. Nerguizian[1]
[1] École de technologie supérieure, Montreal, Quebec, Canada
[2] Concordia University, Montreal, Quebec, Canada

Bending of a Stented Atherosclerotic Artery

H.C. Wong[1] , K.N. Cho[1] , and W.C. Tang[1]
[1] Department of Biomedical Engineering, University of California, Irvine, California, USA

Image-based Simulation of Electrical Impedance Techniques Applied on the Human Thorax for Cardio-pulmonary Applications

A. Harkara[1] , R.M. Heethaar[2] , R.T. Cotton[1] , and F.K. Hermans[2]
[1] Simpleware Ltd., Exeter, UK
[2] VU University Medical Center, Amsterdam, Netherlands

Simulation of Convection in Water Phantom Induced by Periodic Radiation Heating

H. Chen-Mayer[1] , and R. Tosh[1]

[1] Ionizing Radiation Division, National Institute of Standards and Technology, Gaithersburg, Maryland, USA

Finite Element Modeling a Redox-Enzyme-Based Electrochemical Biosensor

Y. Huang[1] , and A. Mason[1]
[1] Electrical and Computer Engineering, Michigan State University, East Lansing, Michigan, USA

Heat Transfer
Friday, October 9, 1:30pm - 3:00pm
Moderator: Thomas Dreeben, Osram Sylvania

Nanoscale Heat Transfer using Phonon Boltzmann Transport Equation

S. Sihn[1,2] , and A.K. Roy[2]
[1] Air Force Research Laboratory, Wright-Patterson Air Force Base, Dayton, Ohio, USA
[2] University of Dayton Research Institute, Dayton, Ohio, USA

Boundary conditions in multiphase, porous media, transport models of thermal processes with rapid evaporation

A. Datta[1] , and A. Halder[1]
[1] Biological and Environmental Engineering, Cornell University, Ithaca, New York, USA

Drying of Corn Kernels: From Experimental Images to Multiscale Multiphysics Modeling

P. Takhar[1] , and S. Zhang[2]
[1] Texas Tech University, Lubbock, Texas, USA
[2] Visualization Sciences Group Inc., Burlington Massachusetts, USA

Solid-Liquid Phase Change Simulation Applied to a Cylindrical Latent Heat Energy Storage System

D. Groulx[1] , and W. Ogoh[1]
[1] Mechanical Engineering Department, Dalhousie University, Halifax, Nova Scotia, Canada

Wall Effects in Convective Heat Transfer from a Sphere to Power Law Fluids in Tubes

D. Song[1] , R. Gupta[1] , and Chhabra[2]
[1] West Virginia University, Morgantown, West Virginia, USA
[2] Indian Institute of Technology, Kanpur, India

Modeling Contact Line Dynamics in Evaporating Menisci

J. Plawsky[1] , A. Chatterjee[1] , and P.C. Wayner, Jr.[1]
[1] Department of Chemical and Biological Engineering, Rensselaer Polytechnic Institute, Troy, New York, USA

Multiphysics II
Friday, October 9, 3:30pm - 5:00pm
Moderator: Oliver Myers, Mississippi State University

Modeling Flow of Magnetorheological Fluid through a Micro-channel

N.M. Bruno[1] , C. Ciocanel[1] and Allison Kipple[2]
[1] Department of Mechanical Engineering, Northern Arizona University, Flagstaff, Arizona, USA
[2] Dept. of Electrical Engineering and Computer Sciences, Northern Arizona University, Flagstaff, Arizona, USA

Multiphysics Simulation of Isoelectric Point Separation of Proteins Using Non-Gel Microfluidic System

A. Contractor[1] , N. Xue[2] , J.B. Lee[2] , and A. Balasubramanian[1] , Gareth [1]

Hughes
[1] Lynntech, Inc., College Station, Texas, USA
[2] Micro Nano Devices and Systems (MiNDS) Laboratory, Department of Electrical Engineering, University of Texas at Dallas, Texas, USA

Electro Magnetic Wave Simulation in Fusion Plasmas

O. Meneghini[1] , and S. Shiraiwa[1]
[1] Plasma Science and Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

Multiphysics Simulation of a Packed Bed Reactor

A.E. Varela[1] , and J.C. García[1]
[1] University of Carabobo, Valencia, Venezuela

COMSOL in a New Tensorial Formulation of Non-Isothermal Poroelasticity

A. Mario-Cesar Suarez[1] , V. Fernando Samaniego[2]
[1] Faculty of Sciences, Michoacan University, Morelia, Mich., Mexico
[2] Faculty of Engineering, National University of Mexico, Mexico City, Mexico

Periodic Near-field Enhancement on Metal-Dielectric Interfacial Gratings at Optimized Azimuthal Orientation

M. Csete[1,2] , X. Hu[1] , A. Sipos[2] , A. Szalai[2] , A. Mathesz[2] , and K. Berggren[1]
[1] Research Laboratory of Electronics, Nanostructures Laboratory, Massachusetts Institute of Technology, Massachusetts, USA
[2] Department of Optics and Quantum Electronics, University of Szeged, Szeged, Hungary

EM Heating
Friday, October 9, 3:30pm - 5:00pm
Moderator: Daniel W. Wilson, NASA Jet Propulsion Laboratory

Modeling of Drying of Cellular Ceramic Structures: Coupled Electromagnetic and Multiphase Porous Media Model

A. Dhall[1] , G. Peng[2] , G. Squier[2] , M. Geremew[3] , L. Bogaczyk[2] , J. George[3] , W.A. Wood[3] , and A.K. Datta[1]
[1] Biological and Environmental Engineering, Cornell University, Ithaca, New York, USA
[2] Manufacturing Technology & Engineering, Corning Inc., Sullivan Park, Corning, New York, USA
[3] Corporate Research, Corning Inc., Sullivan Park, Corning, New York, USA

MultiPhysics Simulation of Direct Double Helix Magnets for Charged Particle Applications

P. J. Masson[1] , and R. B. Meinke[1]
[1] Advanced Magnet Lab, Palm Bay, Florida, USA

Two-Dimensional COMSOL Simulation of Heavy-Oil Recovery by Electromagnetic Heating

M. Carrizales[1] , and L.W. Lake[1]
[1] The University of Texas at Austin, University Station, Austin, Texas, USA

Experimental Observation and Numerical Prediction of Induction Heating in a Graphite Test Article

T.A. Jankowski[1] , D.P. Johnson[1] , J.D. Jurney[1] , J.E. Freer[1] , L.M. Dougherty[1] , and S.A. Stout[1]
[1] Los Alamos National Laboratory, Los Alamos, New Mexico, USA

Analysis of On-Chip Heat Distribution in the Design of RF Power Detectors and RF Transistor Arrays for MMIC Power Amplifiers

D. Roman[1] , A.Dulipovici[2] , and A. Allazam[1] , I. Stiharu[1] , V. Nerguizian[2] , and N. Constantin[2]

[1] Concordia University, Montreal, Quebec, Canada
[2] École de technologie supérieure, Montreal, Quebec, Canada

Transport Phenomena II
Friday, October 9, 3:30pm - 5:00pm
Moderator: Jozef Brcka, Tokyo Electron U.S. Holdings, Inc.

Model of a Filament Assisted CVD Reactor

J. Brcka[1]
[1] TEL US Holdings, Inc., Technology Development Center, Albany, New York, USA

An Analysis of Heat Conduction with Change of Phase with Application to the Solidification of Copper

J. Michalski[1] , and E. Gutirrez-Miravete[2]
[1] Hamilton-Sundstrand
[2] Rensselaer at Hartford, Hartford, Connecticut, USA

Coupled Heat and Mass Transfer Processes in Enclosed Environments

J.L.Wilson[1] , and R. Dwivedi[1]
[1] New Mexico Institute of Mining and Technology, Socorro, New Mexico, USA

Validation of Radiation Computations using Viewfactors and Hemicube Approaches

A. F. Emery[1] , R. Cochran[2] , H. Dillon[1] , and A. Mescher[1]
[1] Department of Mechanical Engineering, University of Washington, Seattle, Washington, USA
[2] Applied CHT, Seattle, Washington, USA

Simulations of Scanning Electrochemical Microscopy Experiments in Pure Negative and Positive Feedback Mode with Ring Microelectrodes

J. Mauzeroll[1] , M. Mayoral[1] , and D. Fabre[1]
[1] Department of Chemistry, Université du Québec à Montréal, Montreal, Quebec, Canada

COMSOL Derived Universal Scaling Model For Low Reynolds Number Viscous Flow Through Microfabricated Pillars – Applications to Heat Pipe Technology

N. Srivastava[1] , and C.D. Meinhart[1]
[1] Department of Mechanical Engineering, University of California Santa Barbara, Santa Barbara California, USA

Optics & Photonics
Friday, October 9, 3:30pm - 5:00pm
Moderator: Ming-Jun Li, Corning, Inc.

"Rapid Prototyping" of Biosensing Surface Plasmon Resonance Devices using COMSOL & Matlab software

J.J. Dubowski[1] , and D.Carrier[1]
[1] Department of Electrical and Computer Engineering, Université de Sherbrooke, Quebec, Canada

Implementation of a Paraxial Optical Propagation Method for Large Photonic Devices

J.E. Toney[1]
[1] Pennsylvania State University Electro-Optics Center, Freeport, Pennsylvania, USA

Modeling Optical Nanoantenna Arrays with COMSOL Multiphysics

Z. Liu[1] , X. Ni[1] , and A. Kildishev[1]
[1] School of Electrical and Computer Engineering and Birck Nanotechnology Center, Purdue University, West Lafayette, Indiana, USA

FE Modeling of Surfaces with Realistic 3D Roughness: Roughness Effects in Optics of Plasmonic Nanoantennas

J. Borneman[1] , A. Kildishev[1] , K. Chen[1] , and V. Drachev[1]
[1] School of Electrical and Computer Engineering and Birck Nanotechnology Center, Purdue University, West Lafayette, Indiana, USA

TM Wave Propagation in Optical Nanostructures with a Third-Order Nonlinear Response: Modeling and Validation with COMSOL

A. Kildishev[1] , E. E. Narimanov[1]
[1] Birck Nanotechnology Center, School of Electrical and Computer Engineering, Purdue University, West Lafayette, Indiana, USA

Measuring the Spectra of Metamaterials at an Oblique Incidence

X. Ni[1,2] , Z. Liu[1,2] , and A.V. Kildishev[1,2]
[1] School of Electrical and Computer Engineering, Purdue University, West Lafayette, Indiana, USA
[2] Birck Nanotechnology Center, Purdue University, West Lafayette, Indiana, USA

Poster Session

2D Extraction of Open-Circuit Impedances of Three-Phase Transformers

R. Escarela-Perez[1] , E.A. Gutierrez-Rodriguez[2] , J.C. Olivares-Galvan[1] , M.S. Esparza-González, and E. Campero-Littlewood[1]
[1] Departamento de Energia, Universidad Autonoma Metropolitana - Azcapotzalco, Mexico D.F., Mexico
[2] Instituto Tecnologico de Aguscalientes, Aguascalientes, Mexico

A Non-isothermal Modeling of a Polymer Electrolyte Membrane Fuel Cell

H. Shin[1]
[1] Department of Mechanical Engineering, University of Michigan – Ann Arbor, Michigan, USA

Calculation of the Magnetic Field Intensity in a Rectangular Conductor Carrying Current inElectromagnetism Introductory Courses

J.C. Olivares-Galvan[1] , I. Hernandez[2] , P.S. Georgilakis[3] , and L.E. Campero[1]
[1] Universidad Autónoma Metropolitana, Azcapotzalco, Mexico, D.F.
[2] Centro de Investigacion y de Estudios Avanzados del IPN, Unidad Guadalajara, Guadalajara, Jalisco, Mexico
[3] School of Electrical and Computer Engineering, National Technical University of Athens, Athens, Greece

Computational Modeling of Magnetorheological Elastomers Using Soft and Hard Magnetic Particles

J. Biggs[1] , P. VonLockette[1] , and S. Lofland[1]
[1] Rowan University, Glassboro, New Jersey

Computing Surface Acoustic Wave Dispersion and Band Gaps

R. Westafer[1] , S. Mohammadi[1] , A. Adibi[1] , and W. Hunt[1]
[1] School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Georgia, USA

COMSOL Implementation of Valet-Fert Model for CPP GMR devices

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COMSOL Multiphysics Modeling of Rotational Resonant MEMS Sensors with Electrothermal Drive

S. Nelson[1] , and M. Guvench[1]
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C. Belavý[1] , G. Hulkó[1] , K. Ondrejkovi?[1] , and P. Zají?ek[1]
[1] Institute of Automation, Measurement and Applied Informatics, Faculty of Mechanical Engineering, Slovak University of Technology in Bratislava, Bratislava, Slovak Republic

Deep Desulfurization of Diesel Using a Single-Phase Micro-Reactor

G. Jovonavic[1] , J. Jones[1] , and A. Yokochi[1]
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Design Simulations of a General Purpose Research Micro Reactor for Methane Conversion to Syngas.

C. Bouchot[1] , and M.A. Valenzuela[1]
[1] Instituto Politécnico Nacional-ESIQIE, México D.F, México

Designing B-field Coils from the Inside-Out

C.B. Crawford[1] , Y. Shin[1] , and G. Porter[1]
[1] Department of Physics and Astronomy, University of Kentucky, Lexington, Kentucky, USA

Effect of S-p Relation Model on DNAPL Migration Simulation Result

H. Ishimori[1] , and K. Endo[1]
[1] National Institute for Environmental Studies, Tsukuba, Ibaraki, Japan

Electro Magnetic Wave Simulation in Fusion Plasmas

O. Meneghini[1] , and S. Shiraiwa[1]
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Error Analysis in Estimating Temperature-Dependent Thermal Diffusivity and Kinetic Parameters using Heat Penetration Data

K.D. Dolan[1,2] , A.R. Sommerlot[1] , and D.K. Mishra[1]
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Expanding Your Materials Horizons

R.W. Pryor[1]
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Experimentally Matched Finite Element Modeling of Thermally Actuated SOI MEMS Micro-Grippers Using COMSOL Multiphysics

M. Guvench[1] , and J. Crosby[1]
[1] University of Southern Maine, Gorham, Maine, USA

Finite element analysis approach for optimization of enzyme activity for enzymatic bio-fuel cell

C. Wang[1] , Y. Song[1] , Y. Parikh[1] , and J.H. Yang[1]
[1] Department of Mechanical & Materials Science Engineering, Florida International University, Miami, Florida, USA

Finite Element Analysis of Microscale Luminescent Glucose Sensors in the Skin Dermis

S. Ali[1] , and M. McShane[2]
[1] Department of Biomedical Engineering, Texas A&M University-College Station, Texas, USA

Fluid Dynamics of Blood Flow during Reperfusion and Post-conditioning

T. Merrill[1] , A. La Barck[1] , and J. Docimo[2]
[1] Rowan University, Glassboro, New Jersey, USA
[2] FocalCool, LLC, Mullica Hill, New Jersey, USA

Linear Convection and Conduction in Cylinders of Water Exposed to Periodic Thermal Stimuli

R.E. Tosh[1] , and H.H. Chen-Mayer[1]
[1] National Institute of Standards and Technology, Gaithersburg, Maryland, USA

Modeling of Nerve Stimulation Thresholds and Their Dependence on Electrical Impedance with COMSOL

P. Krastev[1] , and B. Tracey[1]
[1] Neurometrix, Inc., Waltham, Massachusetts, USA

Modeling of Shrinkage Behavior in Cement Paste Using Thermal-structural Interaction

T. Chen[1] , and P.G. Ifju[1]
[1] University of Florida, Gainesville, Florida, USA

Modeling the Collimator-Detector Scattering Using Stochastic Differential Equations and COMSOL

A. Jeremic[1] , T. Farncombe[2] , S. Liu[2] , and Y. Abdul-Rehman[1]
[1] Department of Electrical and Computer Engineering, McMaster University, Hamilton, Ontario, Canada
[2] Department of Radiology, McMaster University, Hamilton, Ontario, Canada

Modeling Two-Phase Electrophoresis

W. Clark[1] , and M. Lindblad[1]
[1] Chemical Engineering Department, Worcester Polytechnic Institute, Worcester, Massachusetts, USA

Multiphysics Model of the NovaSure Endometrial Ablation Procedure

G.T. Martin[1] , and L. Angelone[2]
[1] Hologic, Inc., Bedford, Massachusetts, USA
[2] Massachusetts General Hospital, Harvard Medical School, Marlborough, Massachusetts, USA

Negative Thermal Expansion Materials: Thermal Stress and Implications for Composite Materials

M.J. Jakubinek[1,2] , C.A. Whitman[2,3] , and M.A. White[1,2,3]
[1] Department of Physics and Atmospheric Science, Dalhousie University, Halifax, Nova Scotia, Canada
[2] Institute for Research in Materials, Dalhousie University, Halifax, Nova Scotia, Canada
[3] Department of Chemistry, Dalhousie University, Halifax, Nova Scotia, Canada

Newtonian and Non-Newtonian Blood Flow over a Backward-Facing Step:

Steady-State Simulation

M.W. Siebert[1] , and P.S. Fodor[1]
Physics Department, Cleveland State University, Cleveland, Ohio, USA

Optimization of a thermal actuator for low power/low cost applications

R. Zúñiga-Quesada[1] , M. Vílchez-Monge[1] , Paola Vega-Castillo[1]
[1] Instituto Tecnológico de Costa Rica, Cartago, Costa Rica

Reliability Evaluation for Static Chamber Method at Landfill Sites

H. Ishimori[1] , K. Endo[1] , and M. Yamada[1]
[1] National Institute for Environmental Studies, Tsukuba, Ibaraki, Japan

Reynolds Number Dependent Porous Media Flow Using the Brinkman Equation

R. Rieck[1] , A. Bénard[1] , and C. Petty[1]
[1] Michigan State University, Michigan, USA

Simulation of Electromagnetic Enhancement in Transition Metamaterials using COMSOL

I. Mozjerin[1] , T. Gibson[1] , and N.M. Litchinitser[1]
[1] Department of Electrical Engineering, The State University of New York at Buffalo, Buffalo, New York, USA

Stochastic Modeling of Biological Systems – Ranking the Model Parameters of the Human Vocal Folds

D. Cook[1]
[1] New York University, New York, USA

Stress Field Simulation for Quantitative Ultrasound Elasticity Imaging

L. Yuan[1] and P.C. Pedersen[1]
[1] Department of Electrical and Computer Engineering, Worcester Polytechnic Institute, Worcester, Massachusetts, USA

Study of Fluid and Mass Adsorption Model in the QCM-D Sensor for Characterization of Biomolecular Interaction

H.J. Kwon[1] , C.K. Bradfield[1] , B.T. Dodge[1] , and G.S. Agoki[1]
[1] Department of Engineering and Computer Science, Andrews University, Berrien Springs, Michigan, USA

The Effect of a Correlated Surface Roughness and Convection on Heat Conduction

A.F. Emery[1]
[1] Department of Mechanical Engineering, University of Washington, Seattle, Washington, USA

Viscous damping of a periodic perforated MEMS microstructure when the Reynolds' equation cannot be applied: Numerical simulations

D. Homentcovschi[1] , and R.N. Miles[1]
[1] Department of Mechanical Engineering, SUNY Binghamton, NY

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Keynote speakers

Darrell Pepper
University of Nevada,Las Vegas

Edwin Ethridge
NASA Marshall Space Flight Center

Marc K. Smith
Georgia Institute of Technology

Michael A. Vallance
GE Global Research

Svante Littmarck
COMSOL

Darrell Pepper, University of Nevada - Las Vegas

Professor of Mechanical Engineering

Benchmarking COMSOL - Part 2: CFD Problems

Darrell Pepper is presently Professor of Mechanical Engineering and Director of the Nevada Center for Advanced Computational Methods (NCACM) at the University of Nevada, Las Vegas (UNLV). In 2004 he was appointed an ASME Congressional Fellow and handled science and engineering issues. Dr. Pepper is also Executive Vice President of Nevada Energy and Environmental Systems. He has published over 200 technical papers on fluid dynamics, heat transfer, and environmental transport topics, and co-authored five textbooks on the finite element method, boundary element method, and indoor air quality.

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Edwin Ethridge, NASA Marshall Space Flight Center

Senior Materials Scientist

Using Microwaves for Extracting Water From the Moon

Dr. Edwin Ethridge is a senior materials scientist in the Materials & Processes Laboratory at the NASA Marshall Space Flight Center in Huntsville, AL. For many years he has had interest in the utilization of extraterrestrial materials for utilization in the development of space systems. Currently Dr. Ethridge has a NASA-HQ LASER grant to investigate the use of microwaves for the extraction of volatiles from lunar soil including water cryotrapped at the poles.

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Marc K. Smith, Georgia Institute of Technology

Professor of Mechanical Engineering

The Use of CFD Simulations in Learning Fluid Mechanics at the Undergraduate Level

Marc K. Smith is a Professor of Mechanical Engineering at the Georgia Institute of Technology. He received his Ph.D. in Applied Mathematics from Northwestern University in 1982. His research interests include interfacial fluid mechanics, boiling flows, and hydrodynamic stability, with particular emphasis on surface tension effects and surface-tension-driven flows. His teaching interests are fluid mechanics, computational fluid mechanics, thermodynamics, and numerical methods at the undergraduate level, using modern software and teaching tools.

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Michael A. Vallance, GE Global Research

Team Leader

Rechargeable Battery for Hybrid Diesel-Electric Locomotive

Michael earned his doctorate in Chemical Engineering for his investigation of nanostructure in segmented co-polymers. Professionally he has focused on materials and energy research at ExxonMobil, Novartis, Honeywell, Plug Power and GE. At GE Global Research, he is developing a high-energy sodium battery for use on a hybrid diesel-electric locomotive. He leads a team investigating electrode microstructure and chemistry. To link structure to performance, Michael started a modeling initiative in 2007.

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Svante Littmarck, COMSOL

President and CEO

COMSOL Multiphysics Version 4

Svante Littmarck is the President and CEO of COMSOL. He co-founded the company in 1986. In 2004, Littmarck received an honorary doctoral degree from the Royal Institute of Technology for the development and international reach of high quality software for scientific computations through his company, COMSOL.

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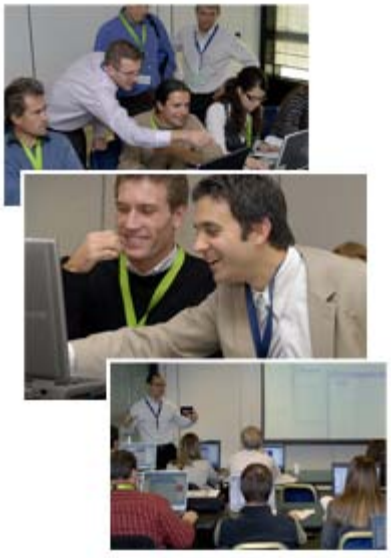

The suite of Hands-on Minicourses and Tutorial Sessions spans a wide spectrum of applications and tools. Minicourses serve as the perfect start for new users by offering hands-on training introducing you to multiphysics simulation applied to fluid flow, structural mechanics, chemical reactions, electromagnetics and much more. Experienced users have the opportunity to advance their skills in the Tutorial Sessions led by the top modeling minds from COMSOL and our partners.

Feel free to bring your own laptop computer for use during these sessions, and to receive a free trial of COMSOL. Seating and computer-for-loan capacity is limited and available on a first-come first-serve basis.

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- Acoustics and Vibration
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- Electrochemical Engineering
- Heat Transfer in Solids and Fluids
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- MEMS and Piezoelectric Simulations
- Microfluidics
- Optimization
- Porous Media Flow
- RF & Microwaves

Tutorial Presentations

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- CAD Import and Parameterized Geometry
- COMSOL Multiphysics with MATLAB®
- COMSOL V4 GUI
- Electromagnetic Bioheating
- Equation Based Modeling
- Fluid Flow
- Fluid-Structure Interactions
- Nonlinear Structural Analysis
- Parallel Processing and Cluster Solutions
- Photonics and Plasmonics
- Tips and Tricks

Hands-On Minicourses

Acoustics and Vibration

Acoustic pressure waves in a fluid are often induced at the interface between a solid and the fluid. This minicourse uses the Acoustics Module to demonstrate mastering unidirectional and bidirectional structural-acoustics interactions. Important application areas are bioengineering, transducer design, and loud

speakers.

Chemical Engineering

The Chemical Engineering Module together with the Reaction Engineering Lab are a powerful couple of products used for mass and energy transport, reaction engineering and fluid flow in reactors and unit operations equipment. During this hands-on minicourse, we will show the interplay between two products while covering topics including multicomponent transport and reactions, chemical kinetics parameter estimation, Batch, Semibatch, CSTRs, and Plug-flow reactors, as well as simulations of 2D and 3D reactors.

Electrochemical Engineering

The Chemical Engineering Module is used to simulate important phenomena that take place in an electrochemical cell, including diffusion, convection, migration and strongly-nonlinear reaction kinetics. Important applications include electrolysis, corrosion, batteries, and fuel cells. This minicourse gives a quick introduction to the techniques used for modeling within electrochemical engineering.

Heat Transfer in Solids and Fluids

Heat transfer enters just about all multiphysics simulations. This minicourse demonstrates heat transfer in solids and fluids including both convection and conduction phenomena. Additional topics covered are simultaneous and communicating heat transfer across solid-fluid boundaries – so called conjugate heat transfer, and how to use the Material Library for representing temperature-dependent material properties.

Introduction to COMSOL Multiphysics

You will be lead through the fundamental work flow in COMSOL through the demonstration of a simple multiphysics simulation example. The hands-on tutorial lets you set up your first model using the physics interfaces.

MEMS and Piezoelectric Simulations

The simulation of microelectromechanical systems is bound to be of a multiphysics nature. Especially important is accurate application of electric boundary conditions and forces on mechanical structures. This minicourse demonstrates the use of the MEMS Module to model microelectromechanical as well as piezoelectric devices including actuators, sensors, and resonators.

Microfluidics

Dive into the world of microfluidics with the tools provided by COMSOL's MEMS Module and Chemical Engineering Module. Learn how the user interface works for electrokinetic flow: electroosmosis, electrophoresis and dielectrophoresis as well as advanced biosensor modeling with thermophoresis. Additional topics include: different methods for simulating two-phase flow systems and reacting flows.

Optimization

This minicourse showcases how to use COMSOL Multiphysics and the Optimization Lab for parametric and geometric sweeps, single-parameter nonlinear optimization, multivariate nonlinear optimization, nonlinear optimization of distributions of parameters and inverse modeling. The Optimization Lab can be applied to any add-on module and applications are numerous.

Porous Media Flow

Here we use the Chemical Engineering Module and the Earth Science Module for linear and nonlinear porous media flow. Topics include: Darcy's law, Brinkman equations, Richards' equation, the interaction between free channel flow and porous media flow, reacting flows and poroelasticity.

RF & Microwaves

This exploration of electromagnetic wave simulations utilizes the RF Module for RF and Microwave applications. Topics covered are: RF coils, antennas, microstrips, filters, extraction of S-parameters, and electromagnetic heating.

Tutorial Presentations

AC/DC and Magnetics Modeling

This class showcases capabilities in the AC/DC Module for simulation of magnetic fields and eddy currents. Topics covered are efficient simulation of permanent magnets, general induction simulations and solver techniques, electrical motors, force and torque calculations and induction heating.

CAD Import and Parameterized Geometry

Curriculum includes how to use the CAD interfaces, geometry repair, meshing techniques, defeaturing, geometry-tolerance adjustments.

COMSOL Multiphysics with MATLAB®

The course focuses on how to build and run a multiphysics model from MATLAB. Learn how to save M-files from the user-interface, driving COMSOL Multiphysics models from MATLAB, and exporting and importing data.

COMSOL V4 GUI

Participants will discover the latest developments in COMSOL's modeling environment in this introduction to the game-changing version 4 user interface. A few key topics include feature-based parameterized geometry, sequencing, automatic solver selection and more.

Electromagnetic Bioheating

This is an introduction to using COMSOL Multiphysics to model biotissue heating including tumor ablation through DC and RF heating. Both the electromagnetic and temperature aspects are covered, as well as damage integrals for accurate calculation of tissue necrosis regions.

Equation Based Modeling

Partial differential equations (PDEs) constitute the mathematical foundation to describe the laws of nature. This course introduces you to the techniques of constructing your own linear or nonlinear PDE systems and how to add ordinary differential equations (ODEs) or even integral equations to your model.

Fluid Flow

Attendees will learn to use the Heat Transfer Module and the Chemical Engineering Module to simulate laminar, turbulent and multiphase flow, as well as forced and free convection.

Fluid-Structure Interactions

COMSOL Multiphysics can perform truly bidirectional fluid-structure interaction where viscous and pressure forces act on an elastic structure and structural velocity forces act back on the fluid. This tutorial presents the ready-made physics interface for this important multiphysics application.

Nonlinear Structural Analysis

This lecture addresses large deformation analysis as well as structural analysis with nonlinear materials. Material models that are elasto-plastic, hyperelastic, and viscoelastic will be covered as well as general tips for nonlinear mechanics modeling.

Parallel Processing and Cluster Solutions

The new release of COMSOL Multiphysics 4.0 features high performance computing (HPC) support for shared-memory systems as well as for clusters. Learn how to make the most of your computing resources and what solvers to use for optimal performance.

Photonics and Plasmonics

This session provides an overview of photonics and plasmonics modeling at the nanoscale withj COMSOL Multiphysics and the RF Module. Topics covered are: photonic crystals, semi-periodic structures, scattering, far fields, magneto-electric (chiral) media, Bloch-Floquet eigenmode analysis, surface plasmon resonances, paraxial optics, and more.

Tips and Tricks

This session showcases some of the most useful, but perhaps not so well known, techniques used for everyday modeling.

- Learning Finite Element Analysis

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Program Overview

2009 Conference Final Program - NEW!

Thursday October 8

11:00 am	**Registration Opens**
12:30 - 02:00 pm	**Breakout Sessions**
	■ Minicourses & Tutorials » Introduction to COMSOL Multiphysics® » COMSOL V4 GUI
02:00 - 02:30 pm	**Coffee Break**
02:30 - 04:00 pm	**Breakout Sessions**
	■ User Presentations ■ Demo Stations ■ Minicourses & Tutorials » AC/DC and Magnetic Modeling » CAD Import and Parameterized Geometry » MEMS and Piezoelectric Simulation » Chemical Engineering
04:00 - 04:30 pm	**Refreshments**
04:30 - 06:00 pm	**General Session**
	■ COMSOL Multiphysics V4 ■ Keynote Presentations
06:00 pm	**Poster Session and Exhibition Open**
06:00 – 07:30 pm	**NASA Tech Briefs Cocktail Reception**

Friday October 9

08:00 am	**Registration and Breakfast**
08:30 - 10:00 am	**Breakout Sessions**
	■ User Presentations ■ Demo Stations ■ Minicourses & Tutorials » Porous Media Flow » RF and Microwaves » Fluid Flow

- COMSOL V4 GUI

10:00 - 10:30 am	**Coffee Break**
10:30 - 12:00 pm	**General Session**

- User Presentation Highlights
- Keynote Presentations

12:00 - 01:30 pm	**Lunch and Dessert**
01:30 - 03:00 pm	**Breakout Sessions**

- User Presentations
- Demo Stations
- Minicourses & Tutorials
  - Electrochemical Engineering
  - Acoustics and Vibration
  - Electromagnetic Bioheating
  - COMSOL Multiphysics with MATLAB®

03:00 - 03:30 pm	**Coffee Break**
03:30 - 05:00 pm	**Breakout Sessions**

- User Presentations
- Demo Stations
- Minicourses & Tutorials
  - Optimization
  - Photonics and Plasmonics
  - Parallel Processing and Cluster Solutions

05:00 - 06:30 pm	**Poster Session and Cocktails**
06:30 – 08:00 pm	**Awards Dinner**

Saturday October 10

08:00 am	**Breakfast**
09:00 - 10:30 am	**Breakout Sessions**

- Demo Stations
- Minicourses & Tutorials
  - Heat Transfer in Solids and Fluids
  - Optimization
  - Equation Based Modeling
  - Fluid-Structure Interactions

10:30 - 10:45 am	**Coffee Break**
10:45 - 12:15 pm	**Breakout Sessions**

- Demo Stations
- Minicourses & Tutorials
  - Microfluidics
  - Chemical Engineering
  - Tips and Tricks
  - Nonlinear Structural Analysis

12:30 pm	**Poster Session and Exhibition Closes**

12:30 - 01:15 pm	**General Session**
	■ Multiphysics Highlights
01:15 - 02:30 pm	**Luncheon**

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These major investments from Microsoft in high-performance computing and parallel programming will enable a broader set of commercial application vendors as well as corporate and research programmers to embrace parallelism and take full advantage of the potential performance gains that are made available through adoption of multicore processors and server clusters.

More information on Windows HPC Server 2008 is available at http://www.microsoft.com/hpc.

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