Conference Schedule

Seventh M.I.T. Conference on Computational Fluid and Solid Mechanics — Focus: Multiphysics & Multiscale

June 12-14, 2013

at the Royal Sonesta Hotel Boston (Cambridge)
40 Edwin Land Boulevard
Cambridge, MA 02142

Conference Schedule Summary

Wednesday, June 12	Thursday, June 13	Friday, June 14
9:00am - 10:30am **Plenary Session**	9:00am - 10:30am **Plenary Session**	9:00am - 10:20am **Parallel Sessions** **1, 2, 3, 4**
11:00am - 1:00pm **Parallel Sessions** **1, 2, 3, 4**	11:00am - 1:00pm **Parallel Sessions** **1, 2, 3, 4**	11:00am – 1:00pm **Parallel Sessions** **1, 2, 3, 4**
2:00pm – 5:00pm **Parallel Sessions** **1, 2, 3, 4**	2:00pm – 5:00pm **Parallel Sessions** **1, 2, 3, 4**	-

Plenary Sessions

Plenary Session for Wednesday, June 12

Chairperson: K.J. Bathe

9:00am - 9:05am
Welcome & Opening Remarks, K.J. Bathe

9:05am - 9:45am
Deviational methods and algebraic decomposition for multiscale transport simulation
N.G. Hadjiconstantinou, Massachusetts Institute of Technology, U.S.A.

9:45am - 10:30am
Future directions for multiscale modeling in biology and medicine – A government perspective
G.C.Y. Peng, National Institute of Biomedical Imaging & Bioengineering, U.S.A.

Plenary Session for Thursday, June 13

Chairperson: B.H.V. Topping

9:00am - 9:45am
Engineer-oriented constitutive modelling
F.J. Montáns, Universidad Politécnica de Madrid, Spain

9:45am - 10:30am
Probabilistic multiscale methods for dealing with localized failure of heterogeneous structures capable of capturing size effects
A. Ibrahimbegovic, École Normale Supérieure de Cachan, France

Parallel Sessions

WEDNESDAY
Session 1 – Session 2 – Session 3 – Session 4

Session 1

Wednesday, June 12

Fluid-Structure Interactions Chairperson: Modarres-Sadeghi, Y.	
11:00am	**Three-dimensional nonlinear cylinder dynamics in channel flow** Jamal, A. et al.
11:20	**Numerical investigation of turbulent pipe flow through a fractal shaped orifice** Al-Atabi, M. et al.
11:40	**Characterizing flow around a cylinder with compressive sensing and machine learning** Kutz, J.N. et al.
12:00	**Breaking the symmetry with flexible blades** Cossé, J. et al.
12:20pm	**Numerical simulation of fluid-body interaction with low and high order flexibility using volume penalization** Engels, T. et al.
12:40	**Flow of wet granular material in a lid driven cavity** Bonkinpillewar, P.D. et al.
1:00	**Lunch**
Fluid-Structure Interactions Chairperson: Deiterding, R	
2:00	**A parallel fluid-structure interaction simulation system for blast and explosion analysis** Deiterding, R. et al.
2:20	**Gust response of a flexible typical section via high- and low-fidelity simulations** Krier, J. et al.
2:40	**Chaotic oscillations of long pipes conveying fluid in the presence of a large end-mass** Modarres-Sadeghi, Y. et al.
3:00	**Modelling of liquid sloshing with constrained floating baffle** Koh, C.G. et al.
3:20	**Coupled particulate and continuum model for nanoparticle targeted delivery** Tan, J. et al.
3:40	**Transport of a flexible polymer in a microchannel with hydrophobic walls** Vedantam, S. et al.
4:00	**Coffee Break**

Fluid-Structure Interactions Chairperson: Lee, P.-S.	
4:20	**Influence of numerical model decisions on the flow-induced vibration of a computational vocal fold model** Shurtz, T.E. et al.
4:40	**Phasing mechanisms between the in-line and cross-flow vortex-induced vibrations of a long tensioned beam in shear flow** Bourguet, R. et al.
5:00	**Domain decomposition and model order reduction methods applied to the simulation of multiphysics problems in MEMS** Corigliano, A. et al.

6:30 – 7:15 **Reception**

7:15 – 9:00 **Banquet**

Session 2

Wednesday, June 12

Numerical Methods for Multiscale and Multiphysics in Reliability and Safety Chairperson: Bayandor, J.	
11:00am	**Dynamic analysis of an overhead transmission line subject to gusty wind loading predicted by wind-conductor interaction** Keyhan, H. et al.
11:20	**Mitigation of component vibrations of guyed transmission towers exposed to wind and atmospheric icing** Egorov, V. et al.
11:40	**Nonlinear interactive earthquake response of Pine Flat Dam to Taft ground motion** Viladkar, M.N. et al.
12:00	**The analysis of massive foundation under dynamic load of three-cylinder machines using cone model and comparison with finite element methods** Mohasseb, S. et al.
12:20pm	**The error estimation of MPA for 2D moment resisting steel frames with geometrical irregularities in elevation** Khodadadi, H. et al.
12:40	**Impact analysis of steel plates by FE-coupled peridynamics** Liu, W. et al.
1:00	**Lunch**
Numerical Methods for Multiscale and Multiphysics in Reliability and Safety Chairperson: Mohasseb, S.	
2:00	**Numerical models for evaluating the soil-structure-interaction effects in seismic behavior of buildings: Case studies for Varzagen-Tabriz earthquake, Iran 2012** Mohasseb, S. et al.
2:20	**Gluing of the continuum and micromechanical models for planar cellular material** Freund, J.
2:40	**Nonlinear vibrations and energy conservation of single-walled carbon nanotubes** Strozzi, M. et al.

3:00	**Material modeling of piezoelectric materials by means of a multiplicative decomposition of the deformation gradient** Humer, A.
Recent Advances in Decomposition Methods for Multiphysics and Multiscale Problems Chairperson: Geiser, J.	
3:20	**Multiscale methods for Levitron problems: theory and applications** Geiser, J.
3:40	**Multi-scale modeling and experimental investigations of geopolymeric gels at elevated temperatures** Kupwade-Patil, K. et al.
4:00	**Coffee Break**
Recent Advances in Decomposition Methods for Multiphysics and Multiscale Problems Chairperson: Geiser, J.	
4:20	**Recent advances in splitting methods for multiphysics problems** Geiser, J.
4:40	**Solving degenerate quenching-combustion equations by an adaptive splitting method on evolving grid*s*** Beauregard, M.A. et al.

6:30 – 7:15 **Reception**

7:15 – 9:00 **Banquet**

Session 3

Wednesday, June 12

Advances and Applications in Structural Analyses Chairperson: Eriksson, A.	
11:00am	**A re-evaluation of modelling the anchorage of deformed bars in reinforced concrete members under bending** Mazumder, M.H. et al.
11:20	**Comparison between precise and statistical methods for modeling cellular wood geometry** Sjölund, J. et al.
11:40	**Direct simulations on rigidity of cellular materials** Karakoç, A. et. al.
12:00	**A macroscopic material law for thin-layered structures under contact and friction including the bending behavior** Karer, E. et al.
12:20pm	**Using a hybrid approach to model curved beams with non-symmetric cross sections** Silva, P.B. et al.
12:40	**Discrete element analysis of the mechanical role of the ribs in groin vaults** Lengyel, G. et al.
1:00	**Lunch**
Advances and Applications in Structural Analyses Chairperson: Payen, D.J.	
2:00	**Constraint path following in non-linear structural optimization** Eriksson, A.
2:20	**3D-shell elements for structures in large strains** Sussman, T. et al.
2:40	**Thermo-mechanical simulations of cooling granitic plutons** Kabele, P. et al.
3:00	**Structural behavior of a rollover carwash machine** Sabet, S.M.M. et al.
3:20	**The development and validation of meso-scale numerical model of fracture in the biocompatible magnesium alloys during drawing of hyperfine wire** Milenin, A. et al.

3:40	**Experimental study on circular cylindrical shells under combined axial loads** Zippo, A. et al.
4:00	**Coffee Break**
Advances and Applications in Structural Analyses Chairperson: Sussman, T.	
4:20	**Application of new technologies in the earthquake design of the tallest building in Switzerland** Mohasseb, S. et al.
4:40	**Closed form elasticity solutions of laminated plates subjected to arbitrary boundary conditions using extended Kantorovich method** Kumari, P. et al.

6:30 – 7:15 **Reception**

7:15 – 9:00 **Banquet**

Session 4

Wednesday, June 12

The Immersed Boundary Method as a Framework for Multiphysics and Multiscale Simulation: Numerical Methods and Applications Chairperson: Peskin, C.	
11:00am	**Immersed boundary simulations of particle sedimentation** Ghosh, S. et al.
11:20	**Multiphysics and multiscale modeling of cardiac dynamics** Griffith, B.E. et al.
11:40	**A three-dimensional front-tracking approach for simulation of a two-phase fluid with insoluble surfactant** de Jesus, W.C. et al.
12:00	**Simulations of DNA dynamics using a stochastic version of the generalized immersed boundary method** Lim, S.
12:20pm	**Image-based fluid-structure interaction models of the human mitral valve** Ma, X. et al.
12:40	**Cardiac dynamics in a patient-specific model of congestive heart failure** McQueen, D.M. et al.
1:00	**Lunch**
The Immersed Boundary Method as a Framework for Multiphysics and Multiscale Simulation: Numerical Methods and Applications Chairperson: Griffith, B.E.	
2:00	**A computational and experimental study of flow induced vibrations of broad leaves** Miller, L.
2:20	**Modeling and simulation of active suspensions containing large numbers of interacting micro-swimmers** Lushi, E. et al.
2:40	**Validation of an immersed finite element method for fluid-structure interaction problems** Roy, S. et al.
3:00	**Massively parallel algorithm for the immersed boundary method** Wiens, J. K.

3:20	**An enhanced immersed structural potential method for fluid-structure interaction biomedical applications** Carreño, A.A. et al.
3:40	**Analysis of non-uniform planar and helical waveforms of flagella using a regularized Stokes formulation** Olson, S.
4:00	**Coffee Break**
The Immersed Boundary Method as a Framework for Multiphysics and Multiscale Simulation: Numerical Methods and Applications Chairperson: Griffith, B.E.	
4:20	**Numerical simulations of two-dimensional wet foam by the immersed boundary method** Kim, Y.
4:40	**Intergranular damage and fracture in polycrystalline materials. A novel 3D microstructural grain-boundary formulation** Benedetti, I. et al.

6:30 – 7:15 **Reception**

7:15 – 9:00 **Banquet**

THURSDAY
Session 1 – Session 2 – Session 3 – Session 4

Session 1

Thursday, June 13

Advances and Applications in CFD Chairperson: Krier, J.	
11:00am	**On homogenization of Stokes flow using weak periodic boundary conditions** Sandström, C. et al.
11:20	**An axisymmetric, pressure stabilised predictive model of surface tension in micro-fluids** Mackenzie, R.J.D. et al.
11:40	**Solid-fluid dynamics of yield stress fluids** Peshkov, I. et al.
12:00	**A hybrid particle-continuum simulation method for multiscale internal rarefied gas flows** Patronis, A. et al.
12:20pm	**A 3D hydroelastic analysis of floating liquid storage structures in water waves** Lee, K.-H. et al.
12:40	**Numerical simulation of atmospheric boundary layer (ABL) based on different computational models** Liu, Z.
1:00	**Lunch**
Advances and Applications in CFD Chairperson: Sussman, T.	
2:00	**Numerical comparison of turbulent and laminar heat transfer for an external natural convection using Cu/water and CuO/water** Kasaeian, A. et al.
2:20	**Two-dimensional simulation of the fluttering instability using a pseudospectral method with volume penalization** Engels, T. et al.
2:40	**Multi-scale modeling and experimental investigations of geopolymeric gels at elevated temperatures** Kupwade-Patil, K. et al.
3:00	**An Eulerian-Lagrangian method for the simulation of the oxygen concentration dissolved by a two-phase turbulent jet system** Torti, E. et al.

3:20	**On the finite element solution of free surface flows** You, S. et al.
3:40	**Computational analysis of high frequency fluid-structure interactions in constricted flow** Salman, H.E. et al.
4:00	**Coffee Break**
Advances and Applications in CFD Chairperson: Tang, D.	
4:20	**Shock wave prediction in safety relief valves using Computational Fluid Dynamics** Elmayyah, W.
4:40	**Attempt to use CFD in estimation of the icing accretion rate on offshore structures due to sea spray** Kulyakhtin, A.

Session 2

Thursday, June 13

Multiscale Dynamics of Defects in Solids: From Metals to Granular Media Chairperson: Ibrahimbegovic, A.	
11:00am	**Elastic, anelastic, and plastic mechanisms of deformation in metallic glasses** Hufnagel, T.C.
11:20	**Spontaneous multiscale dynamics in granular charging** Shinbrot, T.
11:40	**High-dimensional surprises near the glass and the jamming transitions** Charbonneau, P.
12:00	**Flow of jammed quasi-two-dimensional emulsion droplets** Weeks, E.R.. et al.
12:20pm	**Slow dynamics and aging in concentrated nanocolloidal gels and other soft glassy materials** Leheny, R.L.
12:40	**Novel plasticity of purely-repulsive solids near jamming** Shattuck, M.D.
1:00	**Lunch**
Multiscale Mathematical and Numerical Modeling of Enhanced Oil Recovery Methods Chairperson: Ortiz-Tapia, A.	
2:00	**Adaptive fully implicit multi-scale meshless multi-point flux method for fluid flow in heterogeneous fractured media** Lukyanov, A.A.
2:20	**Modeling of foam transport through homogeneous porous media: multiscale possibilities** Ortiz-Tapia, A. et al.
2:40	**A multiscale multiphase flow model for a single fracture in a porous medium at core scale** Diaz-Viera, M. et al.
3:00	**Multiscale modeling of two phase flow in a porous medium with a single fracture using a pore network model** Perez, J. H. et al.

3:20	**Higher-order numerical modeling of CO2 injection in complex processes and complex subsurface formations** Firoozabadi, A. et al.
3:40	**Multiscale finite volume formulation for compositional flows** Hajibeygi, H. et al.
4:00	**Coffee Break**
Multiscale Mathematical and Numerical Modeling of Enhanced Oil Recovery Methods Chairperson: Diaz-Viera, M.	
4:20	**Multiscale method for fine scale reservoir simulation and potential application to enhanced oil recovery** Pal, M. et al.
4:40	**Adaptivity of multiscale methods for oil reservoir simulation** Jenny, P. et al.

Session 3

Thursday, June 13

Error Estimation and Adaptive Methods in Multiscale and Multiphysics Models Chairperson: Grätsch, T.	
11:00am	**On adaptive error control in two-scale finite element analysis of micro-heterogeneous media** Larsson, F. et al.
11:20	**A posteriori analysis of an iterative multi-discretization method for reaction-diffusion systems** Chaudhry, J.H. et al.
11:40	**Adjoint-based adaptive numerical-statistical error balancing for long time averages in chaotic dynamical systems** Wang, Q.
12:00	**Weak penalization for fluid-structure interaction** Nordsletten, D. et al.
12:20pm	**Solving degenerate quenching-combustion equations by an adaptive splitting method on evolving grids** Beauregard, M.A. et al.
12:40	**Anisotropic adaptive meshing and monolithic variational multiscale method for fluid-structure interaction** Hachem, E. et al.
1:00	**Lunch**
Advances in Numerical Solution Procedures Chairperson: Montáns, F.J.	
2:00	**On two direct time integration schemes for wave propagations** Noh, G. et al.
2:20	**Stochastic multi-scale modelling of textile composites based on internal geometry variability** Vanaerschot, A. et al.
2:40	**Boundary integral equation method in the theory of elastic materials with double porosity** Svanadze, M.
3:00	**Enhancing subspace iteration by AMLS for huge eigenvalue problems** Voss, H.
3:20	**Forward-backward-difference time-integrating schemes with higher order derivatives for non-linear finite element analysis of solids and structures** Kaunda, M.

3:40	**Towards an effective finite element method with overlapping elements: The method of finite spheres enriched for wave propagation problems** Lai, B. et al.
4:00	**Coffee Break**
Advances in Numerical Solution Procedures Chairperson: Montáns, F.J.	
4:20	**Large deformation analysis of unsaturated porous media using a meshfree method** Khoshghalb, A. et al.
4:40	**The Constitutive Compatibility Method for stress field reconstruction and material parameters identification using full-field data** Moussawi, A. et al.

Session 4

Thursday, June 13

Multiscale Multiphysics Modeling for Biological Systems Chairperson: Tang, D.	
11:00am	**Dimensional reduction and experimental validation of a beating heart model** Chapelle, D. et al.
11:20	**Regional flow and stress/strain investigation using 3D multi-physics fluid-structure interaction canine ventricle model for tissue regeneration** Zuo, H. et al.
11:40	**Dynamics of high molecular weight proteins and DNA nanostructures** Sedeh, R.S. et al.
12:00	**A study on the usefulness of support vector machines for the realtime computational simulation of soft biological organs** Kumara P, K.
12:20pm	**Interactions of ECM elastin and collagen in vascular mechanics** Zeinali-Davarani, S. et al.
12:40	**Impact of gravitational and pressure loading on cardiac shape and stress/strain distributions using the FE method** Iskovitz, I. et al.
1:00	**Lunch**
Multiscale Multiphysics Modeling for Biological Systems Chairperson: Chapelle, D.	
2:00	**A numerical simulation of the flow in the compliant carotid bifurcation** Seo, T.
2:20	**A multiphysics modeling approach to develop right ventricle pulmonary valve replacement surgical procedures with a contracting band to improve ventricle ejection fraction** Tang, D. et al.
2:40	**Investigation of blood flow through the mitral valve** Lim, Y. et al.

Advances in Wind Turbine Simulations Chairperson: Grätsch, T.	
3:00	**Modelling structural uncertainty of wind turbine rotor blades for aeroelastic investigations** Ernst, B. et al.
3:20	**Fluid-structure interaction analysis of wind turbine blade-tower interaction** Golub, A. et al.
3:40	**Analysis of tower shadow effects on the aerodynamics of floating offshore wind turbines** Lackner, M.
4:00	**Coffee Break**
Advanced Analyses Chairperson: Muscolino, G.	
4:20	**One-dimensional heterogeneous solids with uncertain elastic modulus in presence of long-range interactions: interval versus stochastic analysis** Muscolino, G. et al.
4:40	**Chaotic synchronization of stochastic delayed recurrent neural networks using nonlinear optimal control** Liu, Z.

FRIDAY
Session 1 – Session 2 – Session 3 – Session 4

Session 1

Friday, June 14

Fluid-Structure Interactions Chairperson: Gomba, J.M.	
9:00am	**An Euler-Monte Carlo algorithm assessing Moment Lyapunov Exponents for stochastic bridge flutter predictions** Caracoglia, L.
9:20	**Dissipative particle dynamics simulations of flow in microchannels with hydrophobic and hydrophilic walls** Ranjith, S.K. et al.
Multiscale Multiphysics Mechanics of Ultra-High Performance Cementitious Composites Chairperson: Baylot, J.T.	
9:40	**Recent developments in constitutive modeling of UHPC materials** Magallanes, J.M. et al.
10:00	**Using 3D microstructural imaging for physically-based models of concrete fracture** Landis, E.N. et al.
10:20	**Coffee Break**
Multiscale Multiphysics Mechanics of Ultra-High Performance Cementitious Composites Chairperson: Baylot, J.T.	
11:00	**Numerical simulation of ultra-high performance fiber reinforced concrete in compression and tension** Roy, M. et al.
11:20	**Mathematical homogenization of discrete models for concrete and other quasi-brittle materials** Rezakhani, R. et al.
11:40	**Lattice Discrete Particle Modeling of reinforced concrete beams** Pelessone, D. et al.
12:00	**Graphene nanoplates and multi-wall carbon nanotubes for high-performance cement composites** Zohhadi, N. et al.
12:20	**Lattice Discrete Particle Modeling (LDPM) of Alkali Silica Reaction (ASR) deterioration of concrete structures** Alnaggar, M. et al.

12:40	**High-order microplane theory for elasticity and softening of quasi-brittle materials** Zhou, X. et al.

End of Session 1
Lunch

Session 2

Friday, June 14

Multiscale Dynamics of Defects in Solids: From Metals to Granular Media Chairperson: Muscolino, G.	
9:00am	**On the transition from strain-driven to thermally-assisted yield in amorphous solids** Cao, P. et al.
9:20	**Measuring nucleation rates and free energy landscapes using colloidal particles with tunable potentials** Dinsmore, A.D.
9:40	**Multiscale dynamics of defects in solids: Finite element frameworks used in conjunction with elasto-plastic constitutive theories for crystalline solids** Dawson, P.
Advanced Analyses Chairperson: Sedeh, R.S.	
10:00	**Efficient numerical analysis of reinforced concrete structures with slippage of reinforcement** Spiliopoulos, K.V. et al.
10:20	**Coffee Break**

Advanced Analyses Chairperson: Sedeh, R.S.	
11:00	**A study of bearing stiffness of drilled shaft foundations in heterogeneous rock** Chung, J.H. et al.
11:20	**Impact and blast load analysis of structures with FEM based simulations** Ramezani, A. et al.
11:40	**Extension of the Sussman-Bathe spline-based hyperelastic model to incompressible transversely isotropic materials** Letorre, M. et al.
12:00	**Incremental differential quadrature method for numerical heat transfer analysis of horizontal tube fluid flow using nanofluid** Kasaeian, A. et al.
12:20	**Intelligent formulation of structural engineering systems** Gandomi, A.H., et al.

End of Session 2
Lunch

Session 3

Friday, June 14

Multiphysics in Aerospace Engineering Chairperson: Bayandor, J.	
9:00am	**Multidisciplinary impact damage prediction methodology for jet engines incorporating hybrid structures** Siddens, A. et al.
9:20	**A physics based certification by analysis methodology for aircraft ditching** Anderson, E. et al.
9:40	**The p-version of finite element method for topology optimization** Nguyen, T.H. et al.
10:00	**Development of crushable energy absorbers for an earth entry vehicle** Perino, S. et al.
10:20	**Coffee Break**
11:00	**Unique physics in hypervelocity impact** Thurber, A. et al.
11:20	**Test validation of CFD analyses of a rigid tension cone inflatable aerodynamic decelerator** Armand, S.
Advances in Numerical Solution Procedures Chairperson: Lee, P.-S.	
11:40	**New 3-node isotropic shell finite elements based on the MITC method** Lee, Y. et al.
12:00	**A composite time integration scheme for dynamic adhesion and its application to gecko spatula peeling** Gautam, S.S. et al.
12:20	**Design and optimization of extrusion dies using a GPU parallelized numerical modeling code** Nóbrega, J.M., et al.
12:40	**A two scaled numerical method for global analysis of nonlinear dynamical systems** Jiang, J.

End of Session 3
Lunch

Session 4

Friday, June 14

Multiscale Dynamics of Defects in Solids: From Metals to Granular Media Chairperson: Papanikolaou, S.	
9:00am	**The crossover from random close to random loose packings of frictional disks** Papanikolaou, S.
9:20	**Growth of dynamical heterogeneity in dense granular materials on approach to jamming** Durian, D.J.
9:40	**Multiscale modeling of stress-driven localization process in amorphous solids: atomistic simulation, mesoscopic model and continuum modeling** Li, M.
10:00	**Sharp-interface correction routine ensuring the no-slip velocity condition on fluid-solid interaction interfaces** Valkov, B. et al.
10:20	**Coffee Break**
11:00	**Probing polymer mechanics with covalently bonded mechanochromic units** Silberstein, M.
11:20	**Simulation of granular flow using the Material Point Method** Dunatunga, S.
11:40	**A size-dependent continuum model for predicting dense granular flows** Kamrin, K. et al.
12:00	**Random loose packings of frictional grains** Menon, N.

End of Session 4
Lunch