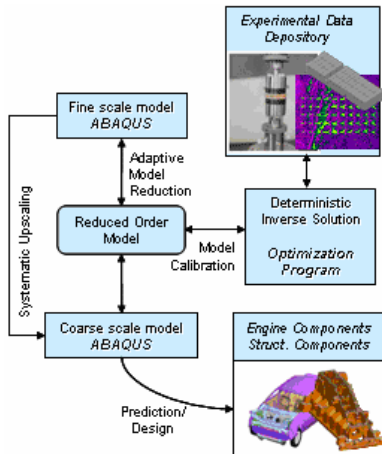


Strategic International Research Seminar in Engineering Science and Technology



Intensive short-course and international seminar on Multiscale Computational Science and Engineering

September 19-21, 2007
 Trondheim, Norway

Organizing Committee:

Kjell Magne Mathisen (chair, NTNU)
 Jacob Fish (RPI)
 Kjell H. Holthe (NTNU)
 Trond Kvamsdal (NTNU/SINTEF)
 Zhiliang Zhang (NTNU)

Intended Audience:

Due to the broad spectrum of application areas, both the short course and the seminar are believed to be of interest and of use to a varied audience, including:

- Graduate and doctoral students and researchers in academia and research institutes who need the fundamental skills that will enable them to advance to the state-of-the-art in the field.
- Practitioners in high-tech industries who are interested in taking advantage of new modeling techniques to solve future scientific and industrial problems.
- Commercial software vendors who are interested in extending their portfolios and tap into new markets.

Limited number of participants:

Please note that the total number of participants is limited to 50 due to the seminar facilities. Therefore early registration is recommended.

Supporting Organizations:

- Faculty of Science and Engineering, NTNU
- Faculty of Information Technology, Mathematics and Electrical Engineering - Computational Science and Visualization Programme, NTNU
- Structural IMPact Laboratory, NTNU
- Inst. of Materials and Chemistry, SINTEF
- Statoil ASA
- Det Norske Veritas
- Hydro Aluminium Structures Raufoss AS

Objective

Industrial success in high technology fields relies on the possibility to specifically engineer materials and products with improved performance. The crucial factor is the ability to make these material-related developments timely at relatively low cost. This demands rapid progress for new processing techniques as well as better understanding and control of material chemistry, processing, structure, physics, performance, durability, and their relationships. This scenario usually involves multiple length, space and time scales and multiple processing and performance stages, which are sometimes only accessible through multiscale/multistage modeling or simulation.

The purpose of the intensive short-course is to present and demonstrate fundamental modeling techniques capable of bridging different physical scales. Such scales range from the atomic level to full-scale products. The short course also addresses the challenges of multiple physical processes interacting at multiple spatial and temporal scales. Applications of multiscale technologies in aerospace and automotive industries, as well as in the emerging fields of nanotechnology and biotechnology, are also discussed.

The purpose of the seminar is to present recent advances in multiscale modeling and computations in mechanics and applied mathematics. The seminar will address both the theoretical bases for multiscale computational methods and the numerical algorithms necessary for efficient and robust computer implementation. Significant advances have recently been made in the formulation and implementation of algorithms for solving multiphysical problems involving multiscale effects. The ability to provide numerical simulations for increasingly complex problems is advancing rapidly due to the remarkable strides in computer hardware development and the improved maturity of computational procedures for multiscale modeling. The aim of the seminar is to give an overview of recent advances and identify future research directions in the field of multiscale modeling.

<http://www.ntnu.no/MSCE07>

Short Course Instructor:

Professor Jacob Fish, Director of the Multiscale Science and Engineering Center at Rensselaer Polytechnic Institute (RPI), New York, USA. Professor Fish has more than twenty years of experience (both in industry and academia) in the field of multiscale computational engineering.

Seminar Lecturers:

- Markus J. Buehler, Massachusetts Institute of Technology, USA
- Jacob Fish, Rensselaer Polytechnic Institute, USA
- Marc Geers, Eindhoven University of Technology, Netherland
- Patrick LeTallec, École Polytechnique, France
- Wing Kam Liu, Northwestern University, USA
- Christian Miehe, University of Stuttgart, Germany
- Kenneth Runesson, Chalmers University of Technology, Sweden

Course and Seminar Materials:

The course material consists of copies of the lecture notes, survey papers by the instructor, and recent manuscripts not yet in press. The complete volume of course notes is available only to registered participants.

The seminar material consists of proceedings of abstracts and copies of the lecture notes.

Social Program:

Seminar dinner at Sverresborg Trøndelag Folkmuseum, Thursday September 20.

Accommodation:

Block reservations have been made at Quality Hotel Augustin located in the center of Trondheim, offering special rates to the MSCE07 participants. Please, note that hotel reservation is the responsibility of each delegate and that block reservations expire on August 19, 2007. Trondheim is quite busy during the month of September, and we recommend that you make hotel reservation as soon as possible.

Location:

Both events will take place at the Paper and Fibre Research Institute (PFI), Høgskoleringen 6b, Trondheim

Registration Fees Delegates / Students:

Short course fee NOK 6000 / 5000
Includes course materials, coffee and lunches.
Seminar fee NOK 3000 / 2500
Includes proceedings and presentations, coffee, lunch and seminar dinner.
Combined fee NOK 8000 / 6500

Important Dates:

NOK 1000 will be added to all the above fees if registration is received after August 19, 2007.

Secretariat:

MSCE07-secretariat, Dept. of Structural Engr., Rich Birkelands v 1a, NO-7491 Trondheim, Norway
Tel: + 47 73 59 47 00,
Fax: + 47 73 59 47 01,
e-mail: msce07@ivt.ntnu.no

Seminar Site:

Detailed information regarding registration and hotel reservation is available on the seminar web site:

<http://www.ntnu.no/MSCE07>

Programme

Wednesday September 19th

0845 – 0900 Welcome and opening address

0900 – 1700 Intensive short-course day 1, *J. Fish*

- Information-passing spatial multiscale approaches
 - Homogenization for linear and nonlinear problems
 - Applications in material design and automotive industry
 - Experimental validation, verification and calibration
 - Multiscale enrichment based on partition of unity
 - Quasicontinuum methods
- Dual purpose spatial scale methods
 - Multiscale enrichment based on partition of unity
 - Quasicontinuum methods
- Concurrent spatial multiscale approaches
 - Current practices (submodeling, global-local)
 - Overlapping and disjoint domains methods
 - Discrete-to-continuum bridging – application in nanotechnology

Thursday September 20th

0900 – 1700 Intensive short-course day 2, *J. Fish*

- Superposition based methods
 - The s-version of the finite element method
 - PUM, GFEM, XFEM, enriched elements
 - Composite grid methods
- Multilevel based methods
- Temporal multiscale approaches
 - Temporal homogenization – application to fatigue life predictions
 - Generalized homogenization – applications in nanotechnology
 - Constrained dynamics
 - Equation-free method
 - Langevin framework
 - Kinetic Monte-Carlo
- Concurrent temporal multiscale approaches
 - Space-time multilevel methods
 - Multiple timestep (MTS) and subcycling methods

Friday September 21st

0845 – 0900 Welcome and opening address

0900 – 1030 A multiscale design system, *J. Fish*

From domain decomposition to homogenization in the numerical modeling of materials, *P. LeTallec*

1030 – 1100 Coffee

1100 – 1230 Variational multiscale approaches to local and non-local dissipative solids, *C. Miehe*

A variational framework including error control for the seamless bridging of scales in continuum modeling, *K. Runesson*

1230 – 1330 Lunch

1330 – 1500 Predictive multiresolution probabilistic nano mechanics and materials, *W. K. Liu*

Atomistic based multiscale modeling of metallic nanomaterials, *M. J. Buehler*

1500 – 1530 Coffee

1530 – 1700 Multiscale computational homogenization: on 1st order, 2nd order, discontinuous, thermal and shell problems, *M. Geers*

Deformation and fracture of hierarchical protein materials, *M. J. Buehler*

1700 – 1730 General discussion and close