# STOMP Course Information

STOMP Short Course for Scientists and Engineers

A STOMP training course will be held at the University of Utah on October 26-27, 2010. The training course will be convened by Dr. Brian McPherson (b.j.mcpherson@utah.edu) and taught by code development staff from the Pacific Northwest National Laboratory. The training will be held in the Sage Point 811 Building, 220 Connor Street, (www.map.utah.edu) in Room 72143M, located on the north end of the first floor. Note that space is limited and registration is on a first-come, first-served basis.

**Agenda**

This course will provide an introduction to STOMP, a multifluid subsurface flow and reactive transport simulator, developed at the Pacific Northwest National Laboratory (PNNL). Through a combination of lectures and computer laboratories students are guided through a series of problems, designed to demonstrate the simulator's features and capabilities. Students will learn to prepare input files for flow and reactive transport problems and interpret simulation results, by working with sample problems that vary in complexity and structure. The sample problems are designed to emphasis specific operational modes of the simulator and to serve as prototypes and templates for applications for the students after the course. Lectures will be used to describe the mathematical models, numerical solution approaches, and code structure, but will also cover a series of simulation applications conducted by the PNNL. Classes will be taught in a computer laboratory with students working in pairs to compile and execute numerical simulations, subsequently convert simulation results to visual form and analyze the generated results. Students will then be challenged with problem variants to expand their numerical simulation capabilities and understanding.

**Simulator Overview**

The STOMP simulator is a suite of computer codes, designated as operational modes, for solving subsurface multifluid flow and reactive transport problems. Operational modes are distinguished by the solved conservation equations and vary in complexity from those involving the isothermal flow of water and dilute solutes with a passive gas, to those involving flow and heat transport for three mobile and three immobile phases. The STOMP simulator has been applied to support laboratory and field investigations: geologic nuclear waste repositories; radionuclide transport; unsaturated zone hydrology; reactive barriers; nuclear waste tank thermal histories; surface barriers; freeze walls; soil desiccation; soil vapor extraction; volatile organic migration and fate; dense nonaqueous phase migration and natural attenuation; geologic sequestration of greenhouse gases; coupled reactive transport; oil shale production; and natural gas hydrate production. STOMP's capabilities and numerical schemes continue to be developed with the current emphasis being gas hydrate production via CO2 injection, oil shale production, and coupled geomechanical modeling. During the short course students will work with the sequential implementation of the simulator. Scientists and engineers at PNNL are currently developing a new scalable version of the

simulator, using the laboratory's Global Arrays tools as a parallel foundation. Scaling has been demonstrated for this implementation of the simulator on 16,000 processors. A suite of demonstration problems have been developed for the short course, which include problems involving multifluid flow, heat transport, nonaqueous phase liquids, salt-water intrusion, geologic sequestration, gas hydrate production, and geochemistry. A subset of these problems will be covered during the course, but students will be encouraged to explore the remaining problems or develop their own problems at the end of the course.

**Topics Covered**

- Introduction to the suite of STOMP simulators and applications
- Governing equations, constitutive equations, numerical solution schemes
- Program flow and structure
- Input file formatting, rules, and tricks
- Developing initial and boundary conditions
- Sources/sinks and well models
- Specifying and importing grids
- Defining rock/soil properties and their spatial distribution
- Executing the simulator, tracking progress, understanding error messages
- Output requests
- Output file conversions, plotting, and visualization

**Course Requirements**

- Knowledge of the physics of fluid flow and heat transport in porous media
- Understanding of numerical methods for solving partial differential equations
- Experience with Linux/UNIX will help but is not necessary
- Familiarity with text editing
- Course will be conducted on a Linux virtual machine operating system

**Course Material**

Course attendees will be provided a CD of all the course materials, including presentations, problems, STOMP Theory Guide, and STOMP User's Guide, printed copies of the covered problems, and given access to computers on which executable copies of the STOMP simulators have been installed.

**Software Availability**

The cost of obtaining a software license for STOMP at the participants' home institute is not included in the short course fees, but participants can acquire a license through the STOMP website (http://stomp.pnl.gov/licensing.stm).

**Cost/Registration**

The registration fee for the two-day course is $200 for professionals and $50 for students and includes lunch and all course materials. To register, please go to http://www.universityguesthouse.com/Conference-Registration. Rooms are also available at the University Guest House for a special nightly rate of $78 until October 16. To reserve a room, please call 1-888-416-4075. Please mention STOMP Short Course to receive the special rate. After the cut-off date, all reservations are subject to availability.