

## CSM TEAM

### Research Group

**Mary F. Wheeler**, Director, Ernest and Virginia Cockrell Chair in Engineering

**Todd Arbogast**, Associate Director and Professor

**Mojdeh Delshad**, Research Professor

**Gergina Pencheva**, Senior Research Associate

**Guangri Xue**, Postdoctoral Fellow

**Mika Juntunen**, Postdoctoral Fellow

**Reza Tavakoli**, Postdoctoral Fellow

**Ben Ganis**, Postdoctoral Fellow

### Staff

**Connie Baxter**, Senior Administrative Associate

**Jorge Florez**, Research Engineer/ Scientist Assistant

**Dino Golgoon**, Web Designer

**Liz Ray**, Administrative Associate

### Students

**Changli Yuan**, Finite element method

**Abraham Taicher**, Mantle dynamics

**Horacio Florez**, Mesh generation, finite element methods

**Omar al Hinai**, Finite volumes and mimetic methods

**Xianhui Kong**, Numerical reservoir simulation

**Zhen Tao**, Multiscale analysis

**Mohammad Reza Beygi**, Compositional flow

**Bin Wang**, Geomechanics

**Hailong Xiao**, Multiscale numerical method

**Gurpreet Singh**, Compositional flow

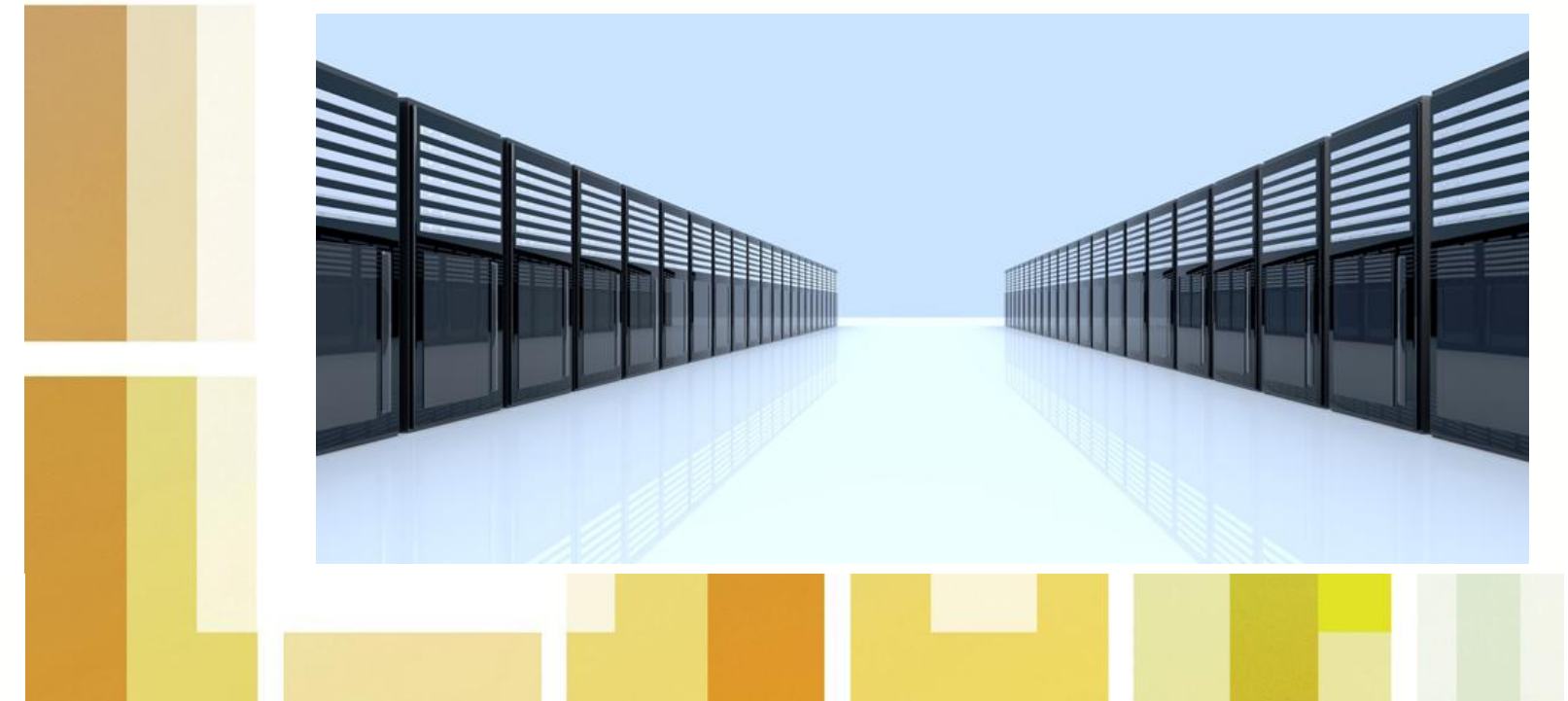
**Jamie Pool**, Transport Methods



**CSM**  
The University of Texas at Austin

## Center for Subsurface Modeling

*Institute for Computational Engineering and Sciences*



**CSM**  
The University of Texas at Austin

1 UNIVERSITY STATION C0200 ACES 5.234 | AUSTIN, TX 78712 | 512.475.8625 t | 512.232.2445 f | [CONNIE@ICES.UTEXAS.EDU](mailto:CONNIE@ICES.UTEXAS.EDU)

**PROFESSOR MARY F. WHEELER, DIRECTOR**

**CONNIE BAXTER, SENIOR ADMINSTRATOR**

**TEL 512.475.8625 FAX 512.232.2445**

**[WWW.ICES.UTEXAS.EDU/CSM](http://WWW.ICES.UTEXAS.EDU/CSM)**

*Solutions that empower your business for success.*

## CENTER FOR SUBSURFACE MODELING

At the Center for Subsurface Modeling, we strive to meet today's numerical modeling challenges by bringing together mathematicians, engineers, geoscientists, and computing experts in a cooperative environment. We believe that a multidisciplinary approach is the best way to obtain accurate, reliable, and efficient solutions to real-world problems. Our researchers work with visitors and industrial partners throughout the world to stay on the cutting edge of scientific advancement.

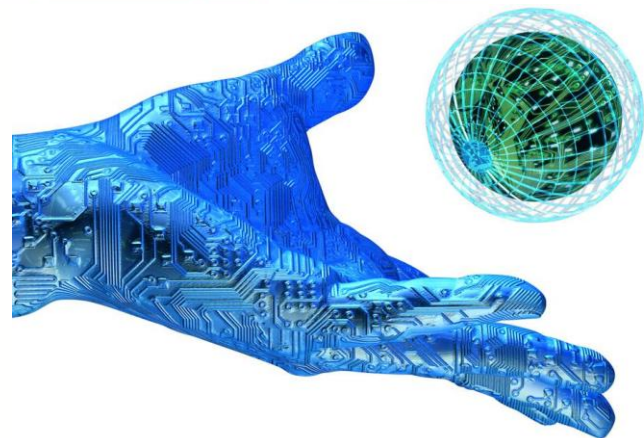
We continually seek to improve existing numerical models by using better physical interpretations, better numerical techniques, and high performance computing. Funds from our Industrial Affiliates program and federal agencies have helped us to develop our own parallel computing environment that enables us to test and prove new concepts in advanced modeling and simulation.

In a rapidly changing world, the Center for Subsurface Modeling is dedicated to developing solutions to tomorrow's modeling challenges today.

### RESEARCH OBJECTIVES

The accurate and efficient simulation of subsurface phenomena requires a blend of physical and geomechanical modeling of subsurface processes and careful numerical implementation. Compounding these issues is a general lack of high quality data from model calibration and verification. CSM researchers collaborate with outside experts to find suitably accurate representations of physical systems, including such processes as fluid phase behavior, particle transport and dispersion, capillary pressure effects, flow in highly heterogeneous media (possibly fractured and vuggy), geomechanical response and subsidence and well production.

These and other processes must be simulated accurately so as to avoid nonphysical numerical artifacts that can cloud engineering judgment regarding risk assessment and the intervention and optimization of management objectives.



### CURRENT PROJECTS

#### Discretizations and Error Estimators

- Multiscale, multiphysics and physics-based discretizations; multipoint flux on general distorted hexahedra with tensor permeability
- Robust a posteriori error estimators for spatial, temporal and linear and nonlinear solvers
- Coupling discrete and continuum approximations through multiscale bases, e.g., fracture networks and continuum models

#### Optimization and Control and Uncertainty

- EnKF, SPSA, and parametrization
- Localization and adaptivity
- Stochastic collocation
- Phase behavior

#### Modeling and Applications

- CO<sub>2</sub> sequestration and CO<sub>2</sub> EOR
- Polymer flooding
- Geomechanics

#### Solvers and High Performance Computing

- Multiphysics couplings (mechanics, flow, energy balance and chemistry)
- Multilevel and multigrid solvers
- Domain decomposition and mortar method

*We can help identify the barriers to your forward progress and create mathematical solutions designed to overcome your obstacles.*



*We offer one source for a variety of business solutions to drive growth and meet your company's objectives.*

### BENEFITS OF MEMBERSHIP

Corporate members have ready access to leading-edge research on a variety of issues in subsurface modeling, parallel processing, and high-performance computing, communicated by:

- Workshops
- Annual and scheduled meetings
- Campus visits by affiliates
- Corporate visits by faculty members
- CSM technical reports, publications and multimedia presentations of activities
- Funded short-term "residences" at CSM in which members of our Affiliates' corporate staff work alongside CSM faculty, scientists, and students.

### PURPOSE

The Center for Subsurface Modeling established an Industrial Affiliates Program in order to foster frequent and open communication between participating researchers and the corporate community. Over the years, this Affiliates Program has proven itself an ideal gateway for launching and conducting collaborative research efforts.

*Professor Mary Wheeler the director of the CSM has been granted a 2011 Humboldt Research Award. This award is given by the Alexander von Humboldt Foundation to internationally renowned scientists and scholars.*

### BENEFITS

#### PROVIDING COMPUTATIONAL SOLUTIONS

##### Software

- Multipoint flux
- Geochemistry packages
- Parallel multiphase modules
- Integrated Parallel Accurate Reservoir Simulator (IPARS)

##### Access

- To potential employees
- To early versions of technical reports
- To research results and to influence its future directions

*Professor Arbogast of CSM is the 2011 Recipient of the "ICES Distinguished Research" award in recognition of his sustained, outstanding research contribution in computational science, engineering and mathematics and for significant contribution to ICES academic and research programs*

### CORPORATE MEMBERSHIP

Corporate sponsorship yields a highly leveraged return, thanks to the large and diverse portfolio of other funding within CSM. It also provides an effective means of conducting exploratory or fundamental research that would not be feasible to perform in-house.

### MEMBERSHIP FEES

The annual fee for membership is \$40,000. These funds primarily support basic research. A small portion defrays the costs of annual meetings, technical reports, computational facilities, travel, and other expenses for graduate students, post doctorates, visitors, and faculty.

