Course title and number: PETE 645: Upscaling of Geologic Models for Flow Simulation
Term: Fall 2011
Meeting times and location: 2:20 – 5:10 p.m., Thursday, RICH 302

Course Description and Prerequisites
This is an advanced reservoir engineering course which covers the upscaling of 3D geologic models for reservoir flow simulation. It is based on published papers and supplemented by research topics. The students will be expected to develop upscaling solvers as part of this course.
Graduate classification. Attendance will be limited to a maximum of 15 students.

Learning Outcomes or Course Objectives
The objectives of the course are for students to:
1. Acquire an in-depth understanding of current approaches to upscaling of geologic models for flow simulation.
2. Develop tools that are more advanced than those available within any commercial application

Instructor Information
Name: Prof. Michael J. King
Telephone number: (979) 845-1488
Email address: mike.king@tamu.edu
Office hours: W, 3:00-5:30 p.m.
Office location: 401E Richardson Building

Textbook and/or Resource Material
Additional readings will be supplied with the course.

Grading Policies
Presentations & Class Participation: ... (10%)  
Homework: ................................................................. (15%)  
Major Project: .......................................................... (25%)  
Mid-Term Exam: ....................................................... (25%)  
Final Exam: ............................................................ (25%)  
Total: ........................................................................ (100%)  

Grading Scale
A................................................................. 90-100%  
B................................................................. 80-89%  
C................................................................. 70-79%  
D................................................................. 60-69%  
F................................................................. 0-59%
Course Topics, Calendar of Activities, Major Assignment Dates
Details may be Varied During the Semester

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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| 1    | Introduction to geologic modeling and flow simulation  
   |   o Uses of geologic models and reservoir simulators  
   |   o Understanding the overall iterative workflow  
   |   o Streamline flow visualization |
| 2    | Basic multi-phase flow equations in porous media  
   |   o Black oil equations  
   |   o Derivation of the pressure equation  
   |   o Neumann and Dirichlet boundary conditions |
| 3-4  | Finite difference/Finite element discretizations/flow visualization and solver projects  
   |   o Five point discretization (2D)  
   |   o Peaceman Well Indices (2D)  
   |   o K/O/U methods (2D)  
   |   o Development of student projects |
| 5-6  | Upscaling of Flow  
   |   o Permeability Upscaling  
   |   o Analytic Approaches  
   |   o Flow Based Upscaling  
   |   o Local / Non-Local / Global Upscaling  
   |   o Transmissibility Upscaling  
   |   o Near Well Upscaling  
   |   o Diagnostics  
   |   o Recommendations |
| 7-8  | Upscaling of Static Properties  
   |   o Stratigraphic Grids  
   |   o Bulk Rock Volume / Net Rock Volume / Pore Volume / Fluid Volumes  
   |   o Facies  
   |   o Well Blocking  
   |   o Diagnostics  
   |   o Recommendations |
| 9-10 | Grid Upscaling  
   |   o Corner Point Grids  
   |   o Multiscale Grid Mapping  
   |   o Error Analysis & Simulation Grid Design  
   |   o Faults and Fault Blocks  
   |   o Unstructured Grids  
   |   o Recommendations |
| 11-12| Multiphase Flow  
   |   o Relative Permeability End-points and Capillary Pressure  
   |   o Steady State Upscaling  
   |   o Pseudoization and Unsteady State Upscaling  
   |   o Multiscale Simulation  
   |   o Recommendations |
| 13-15| Class Projects  
   |   o Student Presentations |
Other Pertinent Course Information

Americans with Disabilities Act (ADA)
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu

Academic Integrity
For additional information please visit: http://www.tamu.edu/aggiehonor

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”