Course MA59800: Numerical Simulation in Applied Geophysics.

From the Mesoscale to the Macroscale.

Professor: Juan E. Santos

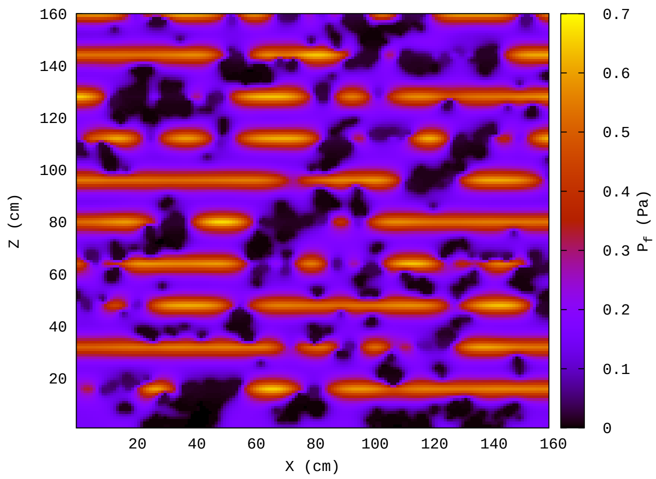
Time& Location: T-Th, 4:30pm-5:45pm, UNIV 217. Number of Credits : 3.

Course Description

Wave propagation is a common technique used in hydrocarbon exploration geophysics, mining and reservoir characterization and production, among other fields.

Local variations in the fluid and solid matrix properties, fine layering, fractures and craks at the mesoscale (on the order of centimeters) are common in the earth's crust and induce attenuation, dispersion and anisotropy of the seismic waves observed at the macroscale. These effects are caused by equilibration of wave-induced fluid pressure gradients via a slow-wave diffusion process that can be analyzed using numerical experiments.

Numerical rock physics offers an alternative to laboratory measurements, being inexpensive and informative, allowing to inspect the physical process of wave propagation using alternative models of the rock and fluid properties. This approach has applications in many fields. In the Petroleum Industry, to analyze the seismic response of unconventional hydrocarbon reservoirs; in Foods Science using ultrasound to monitor the state of foods, such as fruit ripeness and degree of freezing; in Medicine to study how porosity increases in human bones affect velocities and attenuation of ultrasonic waves.



Fluid pressure distribution at 300 Hz in a brine-CO_2 patchy saturated sample with horizontal fractures. Numerical compressibility test for compression normal to the fracture plane.

For additional information send e-mail to santos@math.purdue.edu