FLUIDS & THERMAL SCIENCES

Seminar

"Reduced-order Transport Models for Energy and the Environment"

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1:00 p.m.
B&H Room 190

Abstract:

In this talk, I will discuss several reduced-order transport modeling studies motivated by energy and environmental processes: (i) Inspired by CO_2 geological storage, we study fluid (CO_2) injection into a confined porous reservoir initially saturated with another fluid (brine), and characterize the time evolution of the fluid-fluid (CO_2-brine) interface. Because of the effect of confinement, we identify a transition from an early-time self-similar solution to three branches of late-time self-similar solutions for the interface shape. (ii) Inspired by shale gas recovery, we study the fluid-driven cracks in an elastic matrix and characterize the evolution of the crack shape; we also study the elasticity-driven backflow process following fluid injection, and obtain a simple scaling law to derive a universal crack shape and for the backflow rate of the fracking fluids. (iii) I will also introduce our fundamental study on the viscous fingering instability, which is related to enhanced oil recovery, and report a series of time-dependent strategies for the stabilization of the viscous fingering instability at fluid-fluid (e.g., water-oil, gas-oil) interfaces. I will close the talk by discussing ideas for future exploration and collaboration.

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