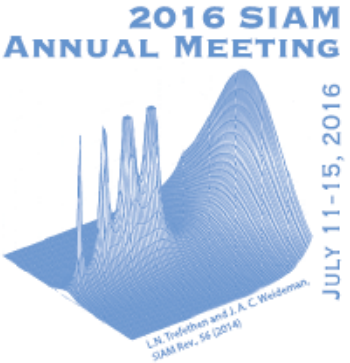
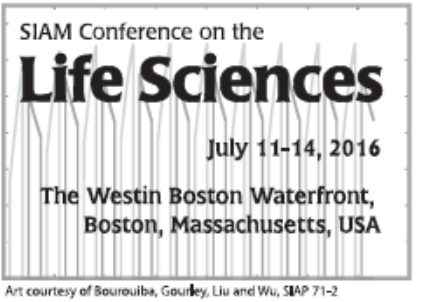
AN16-LS16 Abstracts





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CP13
The Effect of a Variable Viscous Profile on the Stability of Multi-Layer Radial Porous Media and Hele-Shaw Flows

In this talk, we will discuss viscous fingering instabilities of multi-layer immiscible Hele-Shaw flows in a radial flow geometry. In particular, we will consider the potentially stabilizing effect of having fluids with a variable viscous profile as part of the displacement process. This problem is motivated by such processes in Enhanced Oil Recovery and has the potential to aid in improving recovery techniques. We study the stability through both a linear stability analysis and numerical simulations.

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CP13
New Explicit Analytical Solutions to Boundary-Value Problem for Poissons Equations in Application to Groundwater Hydrology/Geomorphology

Dirikhlets BVP for the PE governs steady-state groundwater flow in a mound formed by infiltration [1]. We present explicit solution for a wedge-shaped domain with equipotential boundary conditions on the wedge sides, resulting in a hyperboloidal mound. The discharge vector components, streamlines, quantity of groundwater seeping through segments of the wedge sides, near-vertex volume of groundwater are evaluated. A mixed BVP is solved for a circular triangle as flow domain for the model of gully evolution [2]. [1]Strack, O. D. L. 1989. Groundwater Mechanics. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. [2]Petroff, A.P. Devauchelle, O., Seybold H., and Rothman, D.H., 2013.Bifurcation dynamics of natural drainage networks. Philosophical Transactions A, Royal Society, 371(2004)DOI: 10.1098/rsta.2012.0365

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CP13
Spatial Adaptivity in Stochastic Simulations

Localized descriptions of random fields, such as Markov random fields, provide a means of coupling spatial and stochastic variations. In this talk, we leverage this feature to develop an algorithm for achieving spatial adaptivity in the stochastic setting, through the use of localized, statistical *a posteriori* error estimators. We illustrate our method by investigating the effect of random surface roughness on the behavior of laminar flow through a pipe.

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CP14
Intermediate Materials Alleviate Stress Concentration at Tissue Interfaces

Material interfaces of vastly different Young's moduli, such as bone-to-ligament, develop a stress concentration when subject to tensile loads. To alleviate this, animals are hypothesized to use a transitional region. We test this hypothesis using a 2D elastic model of a transitional region with graded Young's modulus, derive scaling relationships for dependence of its length on the geometric and elastic properties of the adjoining materials, and compare against biological data.

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CP14
Estimation of Shear Stress in Machining by Inversion of Abel Transform

Despite many years of study, the determination of accurate constitutive response models for the flow stress in materials for finite-element simulations of high-speed machining operations remains a difficult open problem. We present a new approach to the problem of estimating shear flow stress in machining. The recent invention of a cutting tool that is transparent in infrared frequencies makes it possible to obtain good in-situ temperature measurements along the chip-tool interface during a steady-state machining operation. By solving a convection-diffusion problem that models the flux of heat into the chip and the tool during a cutting process, the temperature distribution along the tool face can be shown to satisfy a Volterra integral equation of the first kind with a weakly singular kernel, Abel's equation, for the determination of the flow stress. Because the temperature data are experimentally determined, estimation of the flow stress by inversion of the Abel equation under these circumstances is an ill-posed problem. We discuss current progress in finding an approximate solution of this unstable inverse problem using the Truncated Singular Components Method of Rust. As an application of this method, we give estimates of the flow stress in the work