Center for Environmental & Applied Fluid Mechanics

Speaker: Dr. Maša Prodanović (University of Texas at Austin)
Title: *"Integration of image analysis and fluid interface modeling for prediction of flow properties in complex porous media"*

Date: **Friday, October 7, 2011**
Time: 11:00 a.m.
Location: Gilman Hall 50 (Marjorie M. Fisher Hall)

Accurate representation of geometry has the first order influence on multiphase fluid flow in porous media (and more) on all relevant scales. On the micron to millimeter scale, complex void space features are notorious for dictating macroscopic fluid flow due to dominant capillary forces.

Recent advances in non-destructive imaging techniques, such as X-ray computed tomography (CT), as well as the computational and mathematical analysis of the images has made it possible to look into both the pore scale geometry of various porous samples and the geometry of fluids/phases that fill the pore spaces. One thus needs to have both the tools to analyze CT images and the numerical methods to use them (directly or in a statistical sense) to predict flow properties of interest. This feedback loop between imaging and modeling that is true to the original porous medium geometry is typically referred to as the digital rock core laboratory framework.

I will present a specific example of this framework that uses both image analysis of experiments and capillarity dominated flow modeling for computation of interfacial areas and contact lines during immiscible fluid displacement cycles (drainage and imbibition) in porous materials. Competing theories are trying to discuss the contribution of straining of colloids in subsurface at the air-water-solid (AWS) contact line vs. air-water and water-solid interfacial areas, but quantifying these contributions is a work in progress. We develop a computational method based on level set functions to identify and quantify the AWS contact line (in general the non-wetting-wetting-solid contact line) in any porous material. This is the first comprehensive report on contact line measurement for fluid configurations from both level-set method based fluid displacement simulation and imaged experiments.

Joint work with Drs. Elena Rodriguez-Pin and Steven L. Bryant

Bio

Maša Prodanović is an assistant professor at the Department of Petroleum and Geosystems Engineering, The University of Texas at Austin. She holds a Bachelor of Science in Applied Mathematics from the University of Zagreb, Croatia and a PhD in Computational Applied Mathematics from Stony Brook University, New York, USA. She has held a Research Associate position in the Center for Petroleum and Geosystems Engineering (UT Austin) since 2007, and prestigious J. T. Oden Postodoctoral Fellowship at the Institute of Computational Engineering and Sciences prior to her current post. She is a recipient of the Society of Petroleum Engineers Young Professional Outstanding Paper Submission at the ATCE2009. Her research interests include multiphase flow and image-based porous media characterization especially applied to microfractured media and tight gas sandstones, level set method, ferrohydrodynamics, sediment mechanics, and fracturing.