UNIVERSITY OF MARYLAND

THE BURGERS PROGRAM FOR FLUID DYNAMICS
FLUID DYNAMICS REVIEWS SEMINAR SERIES

NUMERICAL SIMULATIONS OF HEAT AND MASS TRANSPORT IN MEMBRANE FILTRATION SYSTEMS

Friday, September 27, 2019 | 11am - 12pm
2164 Martin Hall, DeWALT Seminar Room

Guest Speaker

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ABSTRACT

Population growth, climate change, and overdrawn freshwater sources have provoked a growing potable water deficit that threatens global energy, food, and economic security. Membrane separation processes, such as reverse osmosis, offer promising solutions to this crisis through their applications to desalination, potable reuse, and the treatment of industrial wastewater. The energy efficiency of these processes, however, depend on heat and mass transport that are not well understood because they are challenging to simulate numerically. The challenges include simultaneous heat and mass boundary layers that interact with semi-permeable membranes and vortices shed by bluff bodies with complicated geometries. This talk will present our progress in developing methods tailored to simulating two separation processes: reverse-osmosis and membrane distillation. Using our methods, we explore the accuracy of two popular Nusselt and Sherwood number relationships commonly used in lieu of simulation. We also explore how transition from steady flow to unsteady vortex shedding generates undesirable regions of preferential solute accumulation on membrane surfaces.

BIO

Nils Tilton is an Assistant Professor at the Department of Mechanical Engineering at the Colorado School of Mines. He received his Ph.D. from McGill University in 2009, and was a postdoctoral researcher at the University of Aix Marseille and the University of Maryland. His work focuses on theoretical and computational fluid mechanics with an emphasis on hydrodynamic instabilities, flow through porous media, and membrane separation processes. His work in membrane separations was awarded an NSF CAREER in 2018. His numerical work focuses on projection methods and immersed boundary methods, and their implementation using high-accuracy spectral methods and lower-order finite-volume methods.

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