Temple University Mathematics Colloquium

Howard Stone

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will speak on

Some variants on classical fluid dynamics problems involving pipe flow and particle motion

ABSTRACT: A survey of a few on-going research problems will be given. In the first part of the talk we will look at two kinds of elementary channels flows that have surprising responses. In particular, first we investigate the influence of flow on surface-attached biofilms. We identify the formation of biofilm streamers, which are filaments of biofilm extended along the central region of a channel flow, and show how these filaments are capable of causing catastrophic disruption and clogging of typical flow systems. Second we consider flow in a T-junction, which is perhaps the most common element in a piping systems. The flows are laminar but have high Reynolds numbers, typically Re=100-1000. It seems obvious that any particles in the fluid that enter the T-junction will leave following the one of the two main flow channels. Nevertheless, we report experiments that document that bubbles and other low density objects can be trapped at the bifurcation. Our three-dimensional numerical simulations rationalize the mechanism behind this phenomenon but there are open mathematical questions. In the last part of the talk we study the motion of a hot particle in a viscous liquid at low Reynolds numbers, which is inspired by recent experiments with Brownian particles heated by a laser. The difference in temperature between a particle and the ambient fluid causes a spatial variation of the viscosity in the vicinity of the solid body, which complicates standard solution attempts. We use the Reciprocal Theorem to present a mathematical solution to one aspect of this flow problem.

March 7, 2016
Lecture at 4:00 pm
Coffee, tea, and refreshments from 3:40 pm
Room 617, Wachman Hall
Department of Mathematics