Center for Environmental & Applied Fluid Mechanics

"Clogging: The Self-Sabotage of Suspension Flows"

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From pipes to highways to arteries, stopping the flow is always inconvenient and sometimes dangerous. Clogging can occur whenever a suspension, comprised of discrete particles dispersed in a liquid, flows through a confined geometry. It is a major issue in many engineering systems, such as filtration devices, additive manufacturing, or in bioengineering. In this talk, I will discuss the role of the different clogging mechanisms and our recent efforts to characterize, model, and prevent - or at least delay - the clogging of fluid systems.

First, I will consider clogging by bridging: the formation of a stable arch of particles at a constriction. I will show that clogging by bridging is primarily controlled by the constriction width and the volume fraction of the suspension. Second, I will demonstrate how pulsatile flows can help mitigate clogging by aggregation of colloidal particles when compared to steady flows in microfluidic systems. Finally, I will show new filtration methods for particles of different sizes that rely on interfacial effects and that are less prone to clogging than conventional filters. Even if clogging always occurs in a fluid system, understanding the mechanisms and conditions of clog formation can lead to new design principles and improve the reliability of multiple engineering systems.

Spring 2023 CEAFM Seminar Series

April 28, 2023 ✖ 3:00 PM ✖ Gilman Hall 50