

Johns Hopkins University

Center for Environmental
& Applied Fluid Mechanics

3:00 PM, Friday, October 31, 2025

Gilman Hall 50

Zoom: <https://wse.zoom.us/j/93762992307>

[Link for Fall 2025 recordings](#)



Prof. Chris Boyce

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“Structured Flow Instabilities in Vibrated Gas-Fluidized Granular Materials”

Abstract: Granular materials, such as sand or catalytic particles, exhibit behaviors which blend the lines between solids, liquids and gases. External excitation by gravity, vibration or gas flow can induce motion in granular materials, and forces competing with frictional particle interactions often result in instabilities, many of which resemble those in liquids, while some of which exhibit solid-like behavior. Here, we combine gas flow and vibration experimentally to excite grains to form flow instabilities with structured waves, convection cells, gas bubbles or segregation patterns. Computational modeling demonstrates that some of these instabilities are directly analogous to those in Newtonian fluids, while others involve transitions between fluid-like and solid-like behavior in grains to form structured flow. We develop new rheological models of granular flows which incorporate fluid-solid transition to capture these structured flow instabilities and potentially improve modeling of all granular flows. These structured flows are applied to segregation, mixing and heat transport in granular flows to improve mining separations, pharmaceutical production and chemical reactor design. Finally, we discuss application of similar fluid-solid transition principles to structure flows in dense suspensions as well as utilization of MRI to characterize these flows.

Bio: Chris Boyce is an associate professor chemical engineering at Columbia University, where his research focuses on the physics of multiphase and granular flows. He received his bachelor’s degree in chemical engineering and physics from MIT and then studied at the University of Cambridge as a Gates Cambridge Scholar, where he received the Dankwerts-Pergamon prize for the best PhD thesis in chemical engineering. After his PhD, he held postdoctoral research positions at Princeton University and ETH Zurich. His honors and awards include being named to the Forbes 30 Under 30 List in Science, being honored with the Sabic Young Professional Award from the AIChE for outstanding contributions to particle technology and being recognized with the NSF CAREER Award and the ONR Young Investigator Program Award. He also serves on the editorial board for Powder Technology.

For more details, visit: <https://www.cheme.columbia.edu/faculty/chris-boyce>

Hosted by: Prof. Rui Ni (MechE)