Applied and Computational Mathematics Seminar

Title: Modelling multiphase matter: from microparticles to mega-icebergs

Speaker: Eric Hester (University of Bath)

Date: Wed 26th February 2025 at 10:00AM

Location: (See abstract)

Abstract: This seminar will take place in Science East E1.19.

The world is multiphase. Water and ice, rock and lava, nucleus and cytoplasm. How can we model these systems, and simulate them efficiently? I'll start with three examples from my research, boat drag in dead water, melting icebergs in salty oceans, and phase-separating polymers in microparticle experiments. The same patterns recur. A seemingly simple partition into PDEs and boundary conditions belies the murky interface between them. This diffuse interface in turn motivates a host of numerical schemes and mathematical questions. The bulk of my talk will discuss the mathematical tools we need to understand these methods. Signed-distance coordinates give a straightforward vector calculus around arbitrary submanifolds, and multiple scales matched asymptotics describes the resulting solutions to arbitrary order. I'll show how we can use this knowledge to design more accurate and efficient numerical schemes, and thereby achieve a better understanding of our motivating problems, before concluding with some bigger questions for multiphase methods.