Fabien Evrard is an Assistant Professor of Aerospace Engineering at the University of Illinois Urbana-Champaign. He received an M.Sc. in Aerospace Engineering from the ISAE-SupAéro and an M.Res. in Applied Mathematics from the University of Toulouse, followed by a Ph.D. in Mechanical Engineering from Imperial College London. Fabien's research focuses on the modeling of strongly coupled multiphase flows by means of direct and large-eddy simulation.

Webinar

Title: Conservative two-phase flow simulations using piecewise-quadratic interface reconstructions

Abstract: The volume-of-fluid (VOF) and moment-of-fluid (MOF) methods are widely regarded as state-of-the-art techniques for simulating atomization processes, largely because of their unique ability to conserve mass with machine precision. These methods traditionally employ piecewise-linear interface calculations (PLIC) to produce local geometric approximations of the interface that are used to calculate advective fluxes. However, this choice induces two key limitations: First, because the interface is approximated linearly, the transport of volume fractions is at best second-order accurate, while the estimation of curvature---and thus surface tension---is only zeroth-order accurate. Second, planar approximations often cannot adequately represent interfacial structures whose characteristic length-scales (e.g., radius of curvature or thickness) fall below the grid size. As a result, such features are prone to artificial numerical breakup or coalescence.

This talk presents recent work on interface reconstruction using piecewise-quadratic surface patches, which aims to overcome both of these limitations. The effectiveness of these higher-order approximations is evaluated through convergence studies and advection test cases. Finally, we discuss extending the method to more general classes of implicit surfaces.