Research Statement

My research lies at the intersection of computational fluid dynamics (CFD), scientific computing, and stochastic modeling, with applications in aerospace engineering, environmental systems, and complex multiscale flows. I develop robust, high-fidelity numerical methods for turbulent, separated, and multiscale flows—systems that remain challenging for theory and simulation.

My central goal is improving predictability, stability, and physical realizability of CFD simulations, particularly at high Reynolds numbers. I develop hybrid modeling frameworks, high■order numerical methods, and adaptive solution strategies that bridge efficiency and accuracy.

Current research themes include: (1) Turbulence Modeling & Continuous Eddy Simulation (CES): development of CES■based hybrid RANS–LES methods; (2) High■Order Finite Difference/Volume Methods for hyperbolic equations; (3) Adaptive Simulation Frameworks that adjust solution space using error estimation; and (4) Multiphase and Environmental Flow Simulation with relevance to aerospace and geophysical systems.

Long■term goals include integrating high■order CFD, AMR, uncertainty quantification, ML■assisted turbulence prediction, and HPC to advance next■generation simulation tools.