

AAE SPECIAL SEMINAR

Toward Next-Generation Aerospace Design: Multiphysics Simulations, Adjoint Methods, and AI

WEDNESDAY OCTOBER 15TH, 2025
ARMS 1103 3:30PM-4:20PM



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Abstract

The design of next-generation aerospace systems requires tools that can accurately capture multiphysics interactions, efficiently explore large design spaces, and deliver reliable performance under various operating conditions. In this talk, I will present our recent research advances toward this goal. Our scalable framework integrates multiphysics solvers across aerodynamics, structures, heat transfer, and dynamics and control. We then develop efficient adjoint algorithms for these solvers to enable gradient-based optimization with thousands of design variables and constraints, making multidisciplinary design optimization practical at scale. To mitigate the impact of modeling errors on optimized designs, we incorporate AI to correct model PDE defects, yielding accurate, low-cost multiphysics solvers that generalize across various conditions. We will showcase a range of applications to highlight the versatility of our framework, including aircraft, propellers, spacecraft, thermal systems, and ground/sea vehicles, spanning incompressible to supersonic regimes and steady to unsteady dynamics. Our optimization framework is open source and aims to accelerate the design of high-performance aerospace engineering systems to meet emerging challenges in national security, energy, and mobility.

Biography

Dr. Ping He is an Assistant Professor of Aerospace Engineering at Iowa State University. Prior to joining ISU, he was a research faculty and postdoc at the University of Michigan from 2016 to 2020, and a postdoc at North Carolina State University from 2013 to 2016. He earned his Ph.D. from the Chinese Academy of Sciences in 2012. Dr. He's research focuses on developing efficient numerical methods and tools for multidisciplinary design optimization of large-scale engineered systems, including aircraft, turbomachinery, and spacecraft.