ME Seminar

Understanding Particle-Laden Flows with High-Fidelity Computational Methods

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ABSTRACT

Turbulent flows laden with micron-sized particles are ubiquitous in industrial and environmental applications such as sediment transport in nature and pipelines, operation of aircrafts in dusty environments, manufacturing of pharmaceutical powder, and fluidized bed reactors. Depending on the concentration and size of the suspended particles, the dynamics of these flows may be vastly different from those of particle-free ones. Several questions remain open such as how and why particles cluster in turbulence, how do they alter the near-wall dynamics, and how do they impact mass and momentum transport.

With the growth of computing power, high-fidelity computational approaches may be able to bring answers to these questions. In this talk, I will review two state-of-the-art methods, illustrate their comparative advantages, and their applications. The first method is the Euler-Lagrange approach, or Point-Particle DNS, which is based on a point-particle assumption to reduce the computational cost. The second approach is the Particle-Resolved DNS, a more resource intensive approach in which the particles and surrounding flow are fully resolved. I will discuss the connection between the two methods from the perspective of the volume-filtering method and present on-going work on partially-resolved simulations.

ABOUT THE SPEAKER

Dr. Mohamed Houssem Kasbaoui is an Assistant Professor at Arizona State University in Mechanical and Aerospace Engineering. His research interests include modeling of particle-laden flows for environmental and aerospace applications using massively parallel simulations and reduced order models. Prior to joining ASU in 2019, he was a postdoctoral fellow at the University of Texas at Austin from 2017 to 2018. He received his PhD and MS degrees in Aerospace Engineering from Cornell University in 2017 and 2015, respectively, and Diplome d'Ingenieur from Ecole Centrale Paris in 2013. In 2021, Dr. Kasbaoui received the New Doctoral Investigator Award from the American Chemical Society Petroleum Research Fund.

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