MAE Seminar SERIES

A General Framework to Analyzing Multi-Scale Complex Flows: Applications to Oceanic, Plasma, and Compressible Flows

ABSTRACT

Flows in nature and in engineering are often complex, forced by external agents, boundary stresses, and internal instabilities, and pervaded by multiscale structures such as eddies, plumes, jets, waves, and turbulence ---spanning many orders of magnitude in size. The nonlinear nature of the dynamics implies a coupling between these multiple scales, which often plays a major role in determining mean-flow evolution and is a primary factor limiting our predictive modeling capabilities. To tackle this class of problems in fluid dynamics, I will present a scale-analysis framework we have been developing that is rooted in commonly used techniques in the subjects of PDEs and Large Eddy Simulation modeling (LES). The approach is very general and allows for resolving nonlinear processes at any scale and at any location in the flow. It relies on a synergistic interplay between rigorous mathematics, physical insight, and numerical computations to probe large data sets from simulations, satellite observations, and experimental measurements. I will discuss the application of this methodology to oceanic, plasma, and compressible flows.

Thursday, December 5

3:30 pm

Knox 14

Dr. Hussein Aluie

James P. Wilmot Assistant Professor

Mechanical Engineering

University of Rochester

BIO SKETCH

Hussein is currently the James P. Wilmot Assistant Professor in the Hajim School of Engineering at the University of Rochester (UofR), where he is a faculty member of the Mechanical Engineering Department, the Institute for Matter at Extreme Energy Density, and the Center for Energy and Environment. He is also affiliated with the DOE Laboratory for Laser Energetics at UofR. Prior to UofR, he held a postdoctoral appointment in the Center for Nonlinear Studies at Los Alamos National Laboratory. He earned his PhD from Johns Hopkins University and his BSc from the American University of Beirut. He was recently awarded the DOE Early CAREER Award, and is a member of several professional societies: APS-DFD, APS-DPP, AGU, SIAM, and EUROMECH. His Complex Flow group is diverse both in the composition of its members and in its research, which has appeared in cross-disciplinary journals, including Nature and Physical Review Letters, as well as in disciplinary journals of fluid mechanics, oceanography, plasma physics, applied mathematics, and astrophysics. Hussein was born in Beirut, Lebanon and enjoys outdoor sports activities in their many forms, live music, and swing dancing.

University at Buffalo

Department of Mechanical and Aerospace Engineering

School of Engineering and Applied Sciences