UNIVERSITY OF MARYLAND

THE BURGERS PROGRAM FOR FLUID DYNAMICS
THE FLUID DYNAMICS REVIEWS SEMINAR SERIES

MODAL ANALYSIS OF FLUID FLOWS: INTRODUCTION, APPLICATIONS, AND OUTLOOK

Friday, October 15, 2021 | 11am

DeWalt Seminar Room
2164 Glenn L. Martin Hall

Speaker

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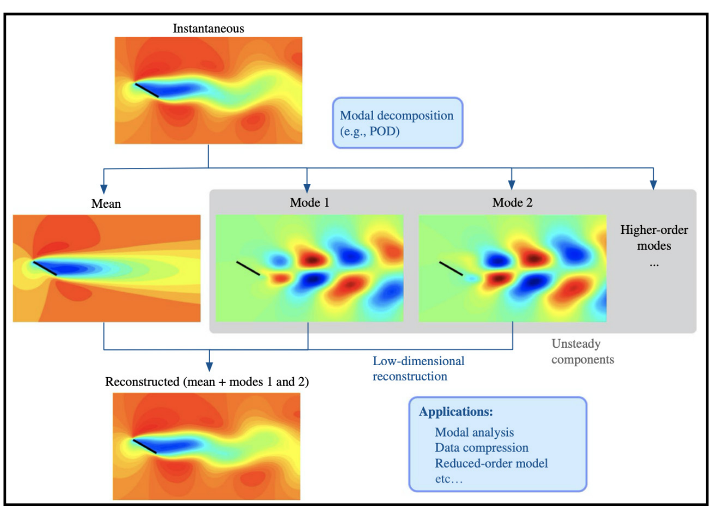
ABSTRACT

With the advancement of high-performance computing and advanced diagnostics, we can collect a large amount of data to study high-dimensional, nonlinear, multi-scale, and turbulent flows. However, the amount of flow field data we collect has become so enormous that it is humanly impossible to examine every data set in detail even with the help of graphs and flow visualizations. To deal with the growing data, we must resort to systematic techniques to analyze dynamically rich flows to extract the dominant physics of interest. In this talk, we will provide an overview on modal analysis techniques that can extract energetic and dynamic spatial modes from the flow field data and the linearized Navier—Stokes operator, including the proper orthogonal decomposition (POD), dynamic mode decomposition (DMD), global stability analysis, and resolvent analysis. Examples will be presented to highlight the utility of these techniques for gaining physical insights into various flows and to control their behavior for engineering benefits. We will also discuss how emerging techniques from data science can be incorporated into modal analysis to accelerate computations and reveal physics from massive data.



BIO

Kunihiko (Sam) Taira is a Professor of Mechanical and Aerospace Engineering at UCLA. His research expertise is in computational fluid dynamics, unsteady aerodynamics, flow control, and data-driven techniques. He received his B.S. degree from the University of Tennessee, Knoxville, and his M.S. and Ph.D. degrees from Caltech. Prior to his current position, he was a faculty member at the Florida State University. He is a recipient of the 2013 U.S. Air Force Office of Scientific Research and 2016 Office of Naval Research Young Investigator Awards and serves as an associate editor for the AIAA Journal.

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