Boulder Fluid and Thermal Sciences Seminar Series

Tuesday, April 17, 2018
9:30am-10:45am (refreshments at 9:15am)
Bechtel Collaboratory in the Discovery Learning Center
University of Colorado, Boulder

The Equivalence Principle and its Application to Scaling Laws for Reacting Flows: What the "Real World" Combustion Industry Wants

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Although direct numerical simulations (DNS) and large eddy simulations (LES) of turbulent reacting flows are used in academia and national laboratories to study various phenomena associated with such flows, the combustion industry primarily uses simple scaling laws to understand and optimize reacting flows for real-world applications. Though not widely known, for non-reacting flows there is a formal procedure for developing highly-accurate fundamentally-based scaling laws for a wide range of simple and non-simple flows. Traditionally, these scaling laws for non-reacting flows have been used by industry as a starting point to develop empirical scaling laws for reacting flows. However, it has recently been shown how the scaling laws for non-reacting flows can be rigorously extended to reacting flows, via an "equivalence principle". This seminar will summarize this procedure, and will present resulting scaling laws obtained from this equivalence principle that apply to both non-reacting and reacting flows. The scaling laws from this are remarkably accurate for both reacting and non-reacting flows, and this new procedure is now widely used in the combustion industry to provide far more accurate predictions of combustion processes than has previously been possible.

Biography: Werner J.A. Dahm has since 2010 been the ASU Foundation Professor of Mechanical and Aerospace Engineering at Arizona State University, where he leads the Laboratory for Turbulence and Combustion and is the Founding Director and Chief Scientist of the Security and Defense Systems Initiative. He is also Emeritus Professor of Aerospace Engineering at the University of Michigan, where he served on the engineering faculty for 25 years.

Previously he was the Chief Scientist of the U.S. Air Force in Headquarters Air Force, serving in the Pentagon as the direct science and technology advisor to the Secretary of the Air Force and the Air Force Chief of Staff. He has served on the Air Force Scientific Advisory Board since 2005, including as Chair of the Board from 2014-2017, and has served on numerous task forces of the Defense Science Board. He has also served on advisory boards for Lawrence Livermore National Laboratory and NASA, and in numerous defense-related reviews and advisory roles.

Dr. Dahm is a Fellow of the American Physical Society and the American Institute of Aeronautics and Astronautics. He is an author of over 200 refereed technical articles, conference papers, and technical publications, a holder of six U.S. and international patents, and has given over 260 technical presentations, including over 190 invited, plenary, and keynote lectures worldwide, on topics dealing with mechanical and aerospace engineering and defense science.