Laufer Keynote Lecture

John Laufer was an internationally known experimentalist in Fluid Mechanics. He founded the Aerospace and Mechanical Engineering Department at USC in 1964 and, as its chairman during the next 19 years, built it into one of the most respected Fluid Mechanics research groups in the country.

John Laufer arrived in the US from Hungary in the 1930s and earned his B.S. degree in Mechanical Engineering (in the Aeronautical Engineering program) from Louisiana State University in 1942, followed by M.S., A.E., and Ph.D. degrees in 1943, 1944, and 1948 from California Institute of Technology. His doctoral thesis on turbulent channel flow and postdoctoral work on turbulent shear layers were fundamental contributions in those fields and are among the classical experimental papers in turbulent shear flows. In 1949 he joined the National Bureau of Standards and produced another classical work on turbulent pipe flow. A few years later he returned to the Jet Propulsion Laboratory. During this time, under AGARD (Advisory Group for Aeronautical Research and Development) sponsorship, he delivered a series of lectures on Fluid Mechanics in France, Italy, Germany and Holland. In 1964 he left his position as Chief of the Gas Dynamic Section at JPL to form the Aerospace Engineering Department at USC. As a prominent scientist in Fluid Mechanics, he was able to attract a group of promising researchers who formed an extremely cohesive group in Fluid Mechanics that produced many innovative and novel ideas and technical accomplishments in Fluid Dynamics.

Professor Laufer served on NASA's Advisory Committee on Fluid Mechanics, on the Board of Editors for *Physics of Fluids* and as an editor for *Applied Mechanics Reviews*. He was a Fellow of the American Physical Society. He was a Fellow of the American Institute of Aeronautics and Astronautics and a member of its Aeroacoustic Technical Committee. In 1977 he was elected to the National Academy of Engineering for his contributions to Fluid Mechanics and for leading his department to its position of prominence in the Fluid Mechanics community. Additionally, Laufer was awarded a Guggenheim Fellowship, a Fulbright-Hayes Fellowship, a NATO Senior Fellowship and the Distinguished Faculty Award from USC.

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The Department of
Aerospace and Mechanical Engineering
presents

The Laufer Keynote Lecture Series 2018

Distinguished Speaker

Reduced order, analytically tractable models remain an important tool in the wind energy area, both for design and control purposes. In this presentation we focus on two fluid mechanical themes relevant to wind farm design and control. The first topic deals with spectral characteristics of the fluctuations in power generated by an array of wind turbines in a wind farm. We show that modeling of the spatio-temporal structure of canonical turbulent boundary layers coupled with variants of the Kraichnan's random sweeping hypothesis can be used to develop analytical predictions of the frequency spectrum of power fluctuations of wind farms. In the second part we describe a simple (deterministic) dynamic wake model, its use for wind farm control, and its extension to the case of yawed wind turbines. The work to be presented arose from collaborations with Juliaan Bossuyt, Johan Meyers, Richard Stevens, Michael Wilczek, Laura Lukasen, Michael Howland, Carl Shapiro and Dennice Gayme. We are grateful for National Science Foundation support.

Charles Meneveau is the Louis M. Sardella Professor in the Department of Mechanical Engineering at Johns Hopkins University and is Associate Director of the Institute for Data Intensive Engineering and Science (IDIES) at Hopkins. He received his B.S. degree in Mechanical Engineering from the Universidad Técnica Federico Santa María in Valparaíso, Chile, in 1985 and M.S, M.Phil. and Ph.D. degrees from Yale University in 1987, 1988 and 1989, respectively. During 1989/90 he was a postdoctoral fellow at the Center for Turbulence Research at Stanford. He has been on the Johns Hopkins faculty since 1990.

His area of research is focused on understanding and modeling hydrodynamic turbulence, and complexity in fluid mechanics in general. The insights that have emerged from Professor Meneveau's work have led to new numerical models for Large Eddy Simulations (LES) and applications in engineering and environmental flows, including wind farms. He also focuses on developing methods to share the very large data sets that arise in computational fluid dynamics. He is Deputy Editor of the Journal of Fluid Mechanics and served (until 2015) for 13 years as the Editor-in-Chief of the Journal of Turbulence.

Professor Meneveau is a member of the US National Academy of Engineering (2018), a foreign corresponding member of the Chilean Academy of Sciences (2005), and a Fellow of the American Academy of Mechanics, the U.S. American Physical Society and the American Society of Mechanical Engineers. He received an honorary doctorate from the Danish Technical University (in 2016), the inaugural Stanley Corrsin Award from the American Physical Society (2011), the Johns Hopkins University Alumni Association's Excellence in Teaching Award (2003), and the APS' François N. Frenkiel Award for Fluid Mechanics (2001).

New analytical models for turbulence spectra and turbine wakes in wind farms

Charles Meneveau

Louis M. Sardella Professor of Mechanical Engineering, and Associate Director, Institute for Data Intensive Engineering and Science

Johns Hopkins University

Wednesday, April 11, 2018
3:00 PM

Michelson Hall Room 101

Seminar will begin promptly at 3:00pm.

Reception immediately after the seminar.