THE UNIVERSITY OF MELBOURNE

2010 Tewksbury Seminar

Department of Mechanical Engineering

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On the Hierarchical Structure of Turbulent Wall-Flows.

Professor Joseph C. Klewicki

Department of Mechanical Engineering
University of New Hampshire
University of Melbourne (01.01.2011)

3pm, Thursday 15th July

Mechanical Engineering Lecture Theatre
Level 3, Mechanical Engineering
Building 170, Block E, Grattan St

It is asserted that the properties of turbulent flows that exist near a material (most often solid) interface are irreducibly connected to an underlying hierarchical structure. The phenomenological and scaling arguments initiated by Prandtl and von Karman as well as those having connection to the Townsend's attached eddy hypothesis are shown to be naturally embodied within a hierarchy paradigm. Furthermore, recent empirical findings associated with both the statistical structure and instantaneous dynamics of turbulent wall flows provide compelling evidence in support of an underlying hierarchy of motions. These evidences are then given strong theoretical support through recent findings (by the author and co-workers) that the time-averaged governing equations formally admit self-similar dynamics on an underlying layer hierarchy. This structure is shown to be directly responsible for many of the mathematical properties intrinsic to the flow, including the logarithmic-like mean profile. Physically, the dynamics on the layer hierarchy are shown to account for the simultaneous processes of momentum transport toward the wall and vorticity transport away from the wall. Potential opportunities to exploit these emerging connections between theory, modelling and observations for the purposes of prediction and control are briefly discussed.

MORE INFORMATION

For more Mechanical Engineering seminar information contact:

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