



Mechanical Engineering Colloquium

February 6, 2015

Macdonald Engineering Building (MD) 267 from 11 - 12 pm

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Certain aspects of flows over rough surfaces

Abstract:

It has been recognized since the pioneering experiments of Reynolds in 1883 that surface roughness plays a significant role in the dynamics of shear layers. This is a classical problem in fluid dynamics but, nevertheless, its resolution is still lacking. Most of the efforts have been focused on experimental approaches that have resulted in a number of correlations but have failed to uncover the mechanisms responsible for the flow response. Theoretical analyses have also failed to provide a consistent explanation of the flow dynamics. As there are an uncountable number of possible geometrical roughness forms, the problem formulation represents a logical contradiction as it might not be possible to find a general answer to a problem that has an uncountable number of variations. The recent progress towards the theoretical resolution of this apparent contradiction will be discussed and recent results dealing with the problem of distributed surface roughness will be presented. The progress has hinged on the development of the immersed boundary conditions method and the reduced geometry concept. It will be shown that it is possible to propose a rational definition of a hydraulically smooth surface by invoking flow bifurcations associated with the presence of roughness. Successful resolution of roughness problems gives access to the design of surface roughness for passive flow control where drag reduction can be achieved either directly, through re-arrangement of the form of the flow that results in the reduction of the shear stress, or indirectly, through delay of the laminar-turbulent transition.

Biography:

Dr. Jerzy M Floryan received PhD from Virginia Tech, US, and postdoctoral training from the Northwestern University, US. He is Fellow of the American Society of Mechanical Engineers, Canadian Society of Mechanical Engineers, Canadian Aerospace and Space Institute, Engineering Institute of Canada and Japanese Society for the Promotion of Science, and Associate Fellow of the American Aeronautics and Space Institute. He has been awarded Humboldt Research Prize in Germany, Senior NATO Research Award in France, Science and Technology Fellowship in Japan and Humboldt Fellowship in Germany. His Canadian awards include Robert W. Angus Medal (Engineering Institute of Canada) and Canadian Pacific Railway Engineering Medal (Canadian Society of Mechanical Engineers). He is also Canadian delegate to IUTAM. Dr. Floryan has held visiting appointments at the Los Alamos National Laboratory (US), German Aerospace Research Establishment (DVL, Gottingen), French Aerospace Research Establishment (CERT-ONERA, Toulouse), National Aerospace Laboratory (Tokyo, Japan), Paul Sabatier University (Toulouse, France), Ohio University (USA) and the National University of Singapore (Singapore).