ME:6260 Viscous Flow Seminar

Date: 04/18/24, 9:30am – 10:45am

Zoom link to join

Title

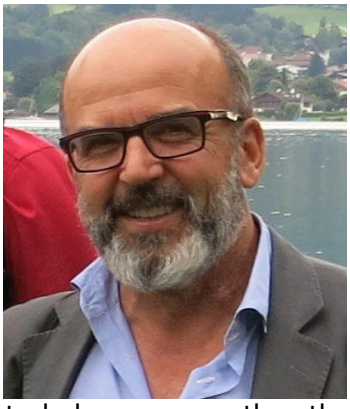
A skin-friction estimation method based on time-resolved TSP data and a Taylor-Hypothesis derived algorithm.

Abstract

There are at least two direct links between the friction acting on the surface of a (slightly warmer or colder) body under the influence of a surrounding flow and the temperature distribution on the surface of the body itself. The first is the so-called Reynolds' analogy, which uses the energy equation to connect the thermal and momentum boundary layers by ascribing the evolution of the temperature distribution at the wall to the action of the skin-friction vector field. On the other hand, a relaxation of the "frozen turbulence" condition at the wall leads to an intriguing derivation of the Taylor Hypothesis, which supplies an operative tool for the skin friction evaluation based on the direct relationship between the celerity of propagation of thermal blobs and the friction velocity. The measurement of friction velocity and skin friction brings a meaningful description of the vorticity generation due to the interaction of the flow field with the body's surface. Moreover, the point of view of the surface allows going deeper inside the onset of flow separation and reattachment in regions where the flow topology strongly alters the boundary layer paradigm.

The presentation reports on the theoretical connection between the celerity of passive displacement of temperature disturbances at the wall and skin friction. The seminar discusses the accuracy and critical issues of the method by illustrating some of its most recent applications. Among them will be considered new results about the case of a lifting NACA 0015 hydrofoil coated by a functional layer of Temperature Sensitive Paint and placed in the wake of a marine propeller.

Short bio



Massimo Miozzi, Ph.D., is a research scientist at the Institute of Marine Engineering CNR-INM (ex INSEAN) in Rome, Italy. His research areas cover experimental and applied hydrodynamics and theoretical hydrodynamics models. He contributed to the development of image-analysis algorithms for the measurement of kinematic quantities in single and multiphase flows and for the skin-friction direct estimation through the measurement of surface temperature via Temperature-Sensitive-Paint. Main topics of application concern the study of the topology at- the-wall of attached and separated flows and associated themes, e.g. active and passive drag reduction as well as transition and turbulence among the others. Other topics of interest focus on geophysical themes and include the physical models of free-surface flows at river mouth and of the wave-excited marine coastal seabed dynamics.