JOHNS HOPKINS
Center for Environmental & Applied Fluid Mechanics

SPRING 2021 CEAFM VIRTUAL SEMINAR

"Tunable Porous and Patterned Surfaces for Turbulence Control"

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Control of wall-bounded turbulent flows has been an active area of research for several decades. However, the development of effective control techniques has been hindered by the limited availability of computationally tractable models that can guide design and optimization. This talk describes extensions of the resolvent analysis framework that seek to address this limitation. Under the resolvent formulation, the turbulent velocity field is expressed as a superposition of propagating modes ('resolvent modes') identified via a gain-based decomposition of the Navier-Stokes equations. Control is introduced into this framework via changes to the boundary conditions or through additional forcing terms. These changes alter the structure and gain of resolvent modes, whereby a reduction in gain is shown to be indicative of mode suppression and drag reduction. This approach reproduces previous observations for passive control techniques such as sharkskin-inspired riblets, compliant walls, and anisotropic porous materials with minimal computation. Ongoing work builds on these observations to develop optimization routines for riblet shape, and to design, fabricate, and test porous materials that can passively control turbulent flows.

Friday, March 12, 2021 at 3:00 PM

https://wse.zoom.us/j/93762992307