

Abstract Submitted
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Interaction of Streamwise Vortices with Surface Textures: Effects of Differential Flow Displacement and Acceleration¹ SAIKISHAN SURYANARAYANAN, DAVID GOLDSTEIN, The University of Texas at Austin, EDWARD WHITE, Texas A & M University, GARRY BROWN, Princeton University — Understanding the interaction of vortices with surface textures is essential for the optimization of control strips for roughness induced transition mitigation (Suryanarayanan et al. AIAA J. 58(7), 2951, 2020). Recently, a simple theoretical model that accounts for the effect of solid surfaces on streamwise vortex evolution by the diffusion of vortex sheets generated on the no-slip surface has been proposed (Suryanarayanan et al. DFD 2019, AIAA 2020-3020). This model provides a bulk prediction of the effect of the strips on a streamwise vortex but requires the relative displacement of the vortex with respect to the strips as an input. This talk focuses on the subsequent development of the theoretical model - (1) prediction of the motion of the vortex axis as it goes over the strip that makes the model self-contained and (2) incorporation of the effects of vortex stretching caused by the streamwise acceleration experienced by the vortex as it goes over the strip. These developments use a combination of existing theoretical ideas and analysis of simple DNS cases. The effects of streamwise evolution of vortex strength and vorticity scooped from the wall on the vertical motion of the vortex axis will also be discussed, along with the application to multiple vortices.

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