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Measurements in turbulent boundary layers over designed anisotropic porous materials[1] CHRISTOPH EFSTATHIOU, MITUL LUHAR, University of Southern California — This talk describes the design and testing of anisotropic porous media with directional resistance as a means of passive flow control of turbulent boundary layers. A high-resolution stereolithographic 3D printer is used to manufacture a substrate with higher streamwise than wall-normal permeability ($\phi_{xy} = k_{xx}/k_{yy} > 1$). Such streamwise-preferential materials have demonstrated potential for passive turbulence suppression and drag reduction in previous idealized simulations. The 3D-printed material is flush mounted into a flat plate boundary setup suspended in a large-scale water channel facility. The friction Reynolds number is varied between $Re_\tau \approx 200$ to $Re_\tau \approx 2000$. Measurements are made using a time-resolved Particle Image Velocimetry system and a 2-component Laser Doppler Velocimeter mounted on a precision traverse. These velocity measurements are used to characterize changes in the mean profile and turbulence statistics, and to test for the emergence of spanwise-coherent rollers triggered by a Kelvin-Helmholtz type instability.

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