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Optimization of drag-reducing surface geometries in turbulent channel flow[1] ASGHAR YARAHMADI, MEREDITH METZGER, University of Utah — Turbulent channel flow over surfaces comprised of spanwise-wavy arrays of longitudinally-oriented riblets was simulated computationally to determine the optimal riblet configuration yielding maximum drag reduction. Surface riblet patterns were characterized by geometric parameters including riblet height, spacing, and cross-sectional shape (i.e., side-wall curvature/slope) as well as the spanwise amplitude and wavelength of the sinusoidal undulation. This parameter space allowed investigation of the following types of riblet surfaces: rectangular, triangular, trapezoidal, notched top, scalloped semicircular, and U-shaped. The surface configuration affording the highest cost savings in terms of skin friction drag reduction was obtained using a multi-objective evolutionary optimization method driven by numerical simulations that were performed using LES with a localized dynamic SGS model, RANS (RSTM and two equations methods) and Detached Eddy Simulation model. The computational efficiency and accuracy of the turbulence models are also discussed.

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Meredith Metzger
University of Utah

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