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Direct Actuation of Small-Scale Motions for Enhanced Heat Transfer in a Straight Channel[1] PABLO HIDALGO, ARI GLEZER, Georgia Institute of Technology — Heat transfer enhancement by small-scale flow interactions that are induced within the core flow of a heated, high-aspect ratio straight channel are investigated experimentally. Direct actuation of small scale motions is provided by streamwise-embedded piezoelectrically-driven cantilevered reeds that span the entire channel height. Deliberate interactions between the reeds and a given core flow lead to the formation of time-periodic vorticity concentrations over a range of vibration frequencies that are advected with the core flow and induce small-scale motions near the channel's surfaces. Heat transfer measurements are obtained using novel, microfabricated heaters with integrated temperature sensors that are deposited on a silicon substrate. It is shown that the actuation disrupts the thermal boundary layers and result in a significant enhancement of the local and global heat transfer along the channel compared to the baseline (unactuated) flow. The interactions between the reed-induced motions and the channel internal surfaces and mixing within the core flow are investigated in detail using high resolution particle image velocimetry (PIV) with emphasis on local and global heat transfer across the channel boundaries.

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