Abstract Submitted
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Small-span simulation of transient half-channel flow with application to riblets[1] SAURABH PARGAL, JUNLIN YUAN, GILES BRERETON, Michigan State University — This work tests the use of low-cost direct numerical simulation of half-channel flows with a small span to simulate non-equilibrium flow in response to step jump in bulk velocity. A setup similar to S. He and M. Seddighi {J. Fluid Mech.},715,60–102(2013) is used with friction Reynolds number increasing from 180 to 418. Spanwise domain length is just sufficient to include near-wall structures within 'healthy turbulence' region. Turbulent flow undergoes reverse transition towards quasi-laminar state, followed by a retransition phase, reaching new equilibrium state. Small-span captures the essential dynamics but shows slight delay in reaching final state, compared to full-span, which is attributed to slower streak transient growth due to exclusion of large attached eddies by limited span. Next, when small-span simulation is carried out in the presence of wall riblets, it was found that riblets delay retransition phase, by reducing streak-meandering and, consequently, weakening streak's transient growth. This work provides confidence on the use of small spanwise domain for extracting essential physics in a non-equilibrium accelerating flow.

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