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Numerical simulations of bypass transition in flat-plate boundary layers VICTOR OVCHINNIKOV, UGO PIOMELLI, University of Maryland, MEELAN M. CHOUDHARI, NASA Langley Research Center — Numerical simulations of bypass transition in the Blasius boundary layer due to free-stream turbulence (FST) typically exclude the flat-plate leading edge. The inflow is usually placed in the Blasius boundary-layer region, and several assumptions are made about the state of the disturbances and the boundary layer at the arbitrary inflow location. We have performed Direct Numerical Simulations (DNS) of bypass transition due to high-amplitude FST in which the leadinge edge of the plate is included. The simulations start well upstream of the flat plate and extend into the fully turbulent region. In the three cases presented, we discuss the effects of varying FST intensity and length scale on the transition process, and examine the evolution of boundary-layer disturbances and the generation of turbulent spots. We present various mean-flow statistics, spectra, correlations, and flow visualizations, and draw comparisons with previous studies with lower FST amplitudes. Research sponsored by the NASA Langley Research Center.

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