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Inception of Klebanoff streaks and large-scale motions in transitional and fully turbulent boundary layers[1] JIN LEE, TAMER ZAKI, Johns Hopkins University — Transitional boundary layers feature long coherent motions of streamwise velocity fluctuation, u', in both the laminar and turbulent regions. In the former, Klebanoff streaks amplify and become seats for breakdown to turbulence. In the fully turbulent region, large-scale motions contribute appreciably to the turbulence energy and shear stresses. Direct numerical simulation (DNS) of boundary-layer bypass transition over a flat plate with a leading edge is performed. Instantaneous realizations of spatially and temporally resolved fields are stored in a database. Structure identification techniques are used to identify these coherent flow structures [Lee, Sung & Zaki, *J. Fluid Mech.* **819**, 165-187 (2017)]. The inception rate, lifetime and amplification rate of Klebanoff streaks are evaluated in the laminar region, and conditional averaging is used to examine the early stages of streak formation. Structure identification and tracking is also used to study the inception of large-scale coherent motion in the nascent turbulent spots and fully turbulent boundary layer downstream.

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