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Centrifugal Instability of Coandă Flows[1] LEV DUNAEVICH, DAVID GREENBLATT, Technion - Israel Institute of Technology — The first observations of stationary streamwise vortices within a centrifugally unstable laminar wall-jet flowing over a circular (Coandă) cylinder are presented. Flow visualization was used to analyze streamwise vortices and shear layer development, while PIV was used to determine the vortices' size and strength. Exponential growth of the shear layer was characterized by a linear dependence of the growth-rate parameter exponent on the Goertler number (G). Extrapolation of the growth-rate parameter to zero produced the first-ever experimental estimate of the critical Goertler number, namely 3.1, which compared remarkably well with stability theory (3.5). Increases in G resulted in a second time-dependent wavy instability whose median frequency increased linearly. Transition occurred at G=28, and was accompanied by multiple vortex wavenumbers and a large range of frequencies. Furthermore, transition corresponded to a minimum separation angle as a function of G for the following reasons. With increasing G, the relatively thick vortex-driven shear layer was more susceptible to separation and thus the separation angle, relative to the slot, decreased. However, following transition to turbulence, the high-momentum fluid near the wall that resulted from turbulent mixing, produced a subsequent increase in the separation angle.

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