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Sidewall boundary layer instabilities in a rapidly rotating cylinder driven by a differentially co-rotating lid JUAN LOPEZ, Arizona State University, FRANCISCO MARQUES, Universitat Politècnica de Catalunya — The flow in an enclosed completely filled rapidly rotating cylinder that is driven by the differential co-rotation of the top lid is studied numerically. Although the flow is in a very simple geometry, the fast background rotation and large differential rotation of the lid lead to very thin boundary layers with a variety of instability modes with very fine spatial scales as well as inertial waves that are sustained in the fast rotating interior flow and which interact with the viscous modes in the sidewall boundary layer leading to complex spatio-temporal dynamics. The numerical simulations are compared and contrasted to experimental visualizations of the sidewall boundary layer instabilities reported by Hart and Kittelman (1996), that include axisymmetric rolls propagating down the sidewall layer, backwards tilted diagonal rolls that precess slightly retrograde with respect to the rotating sidewall, forward tilted rolls with prograde precession significantly faster than the sidewall rotation, and a wavy turbulent state that has backwards tilted structures erupting from deep within the sidewall layer into the interior and are riding on the forward tilted diagonal rolls in the deep layer.

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