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Boundary Slip Effects on the Linear Stability of Circular and Spiral Poiseuille Flow[1] D. COTRELL, LLNL, G. MCFADDEN, NIST — In this work, we consider the effect of boundary slip on the linear stability of various internal flows having boundary curvature. For the case of annular flow, slip can have a small to moderate affect on the linear stability analysis, with results showing that if the linear stability analysis gives a finite transition for no-slip boundary conditions, then the addition of slip can have either a stabilizing or destabilizing effect on the flow depending on the radius ratio. The results also show that for fixed Knudsen number, there is a value of the radius ratio for which there is no difference between linear stability results with and without slip, and that this value of the radius ratio changes with Reynolds number as does the number of crossings (i.e., one crossing for a Reynolds number of zero and two for a Reynolds number of 100). As for the annular special case (i.e., Taylor-Couette flow with $\mu > \eta^2$), results show that relaxing the no-slip condition on the cylinder walls does not destabilize this flow (i.e., computations still give a critical value of infinity). Similar to these results, for circular Poiseuille flow (i.e., pipe flow) current results show that relaxing the no-slip boundary condition on the cylinder wall does not destabilize the flow.

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