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Float height and quasi-steady spin-down of a rotating disk
PATRICK WEIDMAN, University of Colorado — Numerical integrations of the self-similar equations for steady fluid motion between parallel infinite disks are reported for the case where the upper impermeable disk rotates and the lower stationary disk has uniform transpiration. The numerics are facilitated by a high-Reynolds number asymptotic analysis. The results are applied to model the float height of the steadily spinning disk under gravity when the disk separation is small. We find that the disk will touch down when it has sufficiently high angular rotation. Boundaries separating regimes of radial outflow from counter-flow and disk touch down are determined over a range of blowing Reynolds numbers R and swirl parameters S. In certain regimes of parameter space and disk geometry the results provide a quasi-steady estimate for the spin-down dymamics of a disk in free rotation over an air-bearing table. Experiments are under way to test the validity of this quasi-steady approximation.

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