

On the Stability of the Flow Close to One or Two Rotating Disks

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Polarization curves found in electrochemical cells with rotating disk electrodes present an instability in the region where the current depends exclusively on the angular velocity imposed to the rotating disk electrode. Dissolution of the iron electrode in the **1M H₂SO₄** electrolyte generates a mass concentration field close to the electrode, coupled through the viscosity, to the flow. We review key aspects of the linear stability of the coupled flow and show that coupling gives rise to a new family of unstable modes at Reynolds number much lower than the critical one for constant viscosity flows. These modes may be at the origin of the current instability observed in the setup (*Phys. Fluids*,16(3):707, 2004, *Phys. Fluids*19:114109, 2007). Three-dimensional numerical simulations confirm the emergency of the instabilities. We address also the problem of multiple solutions in the between corotating disks.

Keywords: Rotating disk flow, rotating disk electrode, hydrodynamic stability, finite elements method