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Matrix-free continuation methods for electroconvection

We investigate the flow transitions in sheared annular electroconvection using matrix-free numerical bifurcation methods. In particular, we study a model that simulates the flow of a liquid crystal film in the Smectic A phase suspended between two annular electrodes, and subjected to an electric potential difference and a radial shear. Due to the Smectic A nature of the liquid crystal, the fluid can be considered two-dimensional and is modelled using the 2-D incompressible Navier-Stokes equations coupled with an equation for charge continuity. The matrix-free method is implemented to identify the transitions of the flow that result due to changes in the Rayleigh number. The primary transition from axisymmetric flow to rotating waves, and the secondary transition from rotating waves to amplitude vacillation are investigated. This is joint work with Jamil Jabbour of UOIT, and Mary Pugh and Stephen Morris of the University of Toronto.