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The effects of a uniform axial magnetic field on the global stability of the rotating-disk boundary-layer CHRISTOPHER DAVIES, CHRISTIAN THOMAS, Cardiff University — Following on from the earlier discovery by Lingwood (1995) that the rotating-disk boundary-layer is absolutely unstable, Jasmine & Gajjar (2005) have shown that the application of a uniform axial magnetic field can raise the critical Reynolds number for the onset of absolute instability. As with Lingwood's analysis, a 'parallel-flow' type of approximation is needed in order to derive this locally-based stability result. The approximation amounts to a 'freezing out' of the underlying radial variation of the mean flow. Numerical simulations have been conducted to investigate the behaviour of linearized disturbances in the genuine rotating disk boundary layer, where the radial dependence of the mean flow is fully accounted for. This extends the work of Davies & Carpenter (2003), who studied the more usual rotating-disk problem, in the absence of any magnetic field. The simulation results suggest that globally unstable behaviour can be promoted when a uniform axial magnetic field is applied. Impulsively excited disturbances were found to display an increasingly rapid growth at the radial position of the impulse, albeit without any selection of a dominant frequency, as would be more usual for an unstable global mode. This is very similar to the behaviour to that was observed in a recent investigation by Davies & Thomas (2005) of the effects of mass transfer, where suction was also found to promote global instability.

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