

Instability Thresholds of Flow Between Exactly Counter-Rotating Disks

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The von Karman flow engendered by the differential rotation of the upper and lower bounding disks of a cylinder exhibits a large variety of phenomena, and depends on three parameters, an angular velocity ratio, an aspect ratio and a Reynolds number. This flow is of growing interest to fluid dynamicists, but its three-dimensional patterns and transitions have as yet been explored for only a few parameter combinations. We present the linear three-dimensional instabilities of the flow between exactly counter-rotating disks for height-to-radius aspect ratios between 0.5 and 3. The lowest Reynolds number threshold always corresponds to a non-axisymmetric and stationary eigenmode and the critical azimuthal wavenumber is approximately proportional to the radius. The axisymmetric instabilities are quite complicated, and are organized around various codimension-two points.

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