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Formation of polygonal flow pattern between two corotating disks in an enclosure TOMOHITO MIURA, JIRO MIZUSHIMA, Faculty of Engineering, Doshisha University — Pattern formation and transitions of flow between two corotating disks in a cylindrical enclosure is investigated numerically and experimentally. The outer cylindrical boundary of the flow field is assumed to being fixed, whereas the inner cylinder rotates together with the two disks. The flow is not only symmetric with respect to the inter-disk midplane but also axisymmetric around the axis of rotation at small Reynolds numbers. The axisymmetry of the flow field is broken due to instability at high Reynolds numbers. Such an instability occurs for small gap ratios, the ratio of the gap between two disks to the radius of the annulus, and yields a polygonal flow pattern in a plane normal to the rotation axis. We identified two kinds of three-dimensional (3D) unsteady flow by numerical simulations, one of which is asymmetric with respect to the inter-disk midplane and the other has a shift-and-reflect symmetry with the midplane, and compared them with those obtained by experiment. We evaluated the critical Reynolds number at which the axisymmetric flow makes a transition to 3D unsteady flow and found that the axisymmetry is broken due to Hopf bifurcation.

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