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Effect of Rim-Shroud Clearance on the Flow Developing around a Finite-Thickness Rotating Disk in a Cylindrical Enclosure

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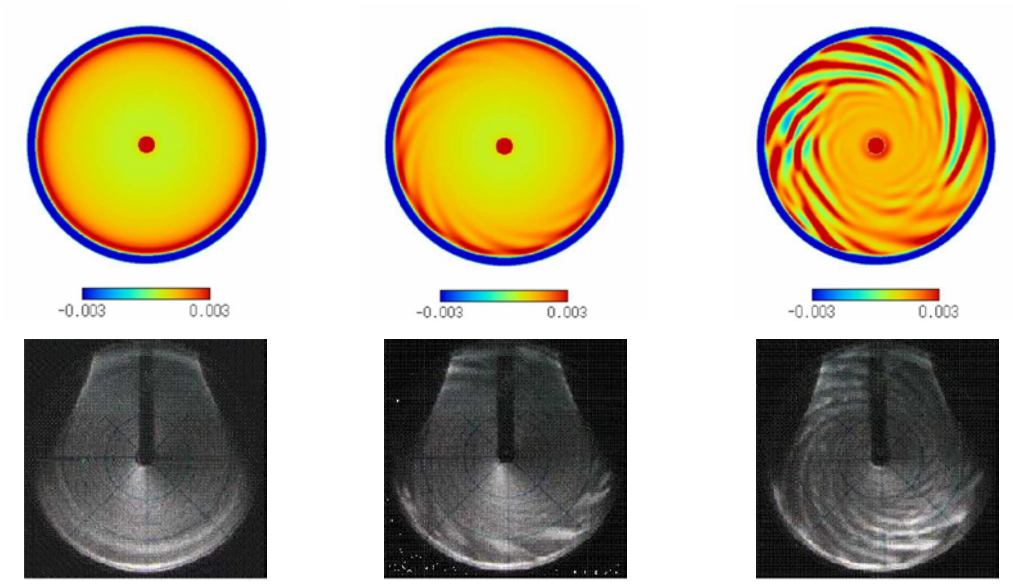

Re = 5000 *Re* = 5602 *Re* = 12000

Fig. 1. Numerical result of the axial velocity component profiles and experimental observation of flows in the Bödewadt layer. The ratios of radial clearance and upper and lower clearances to the inner radius of the enclosure are 0.106, 0.105 and 0.105, respectively.

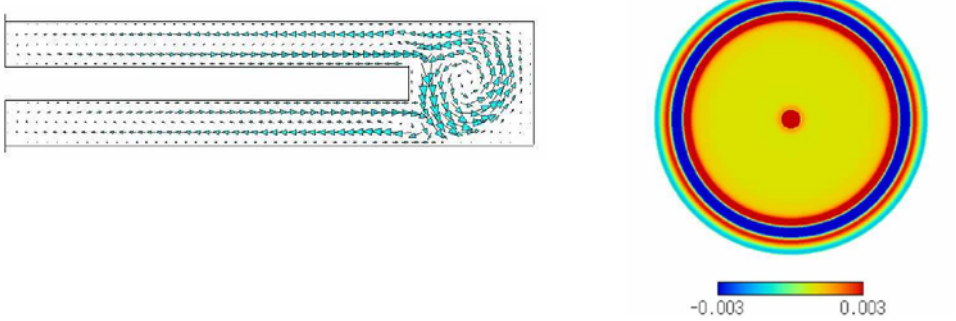

Fig. 2. Profile of the axial velocity component in the axial section and velocity vectors in the circumferential section at *Re* = 3000. The ratios of radial clearance and upper and lower clearances to the inner radius of the enclosure are 0.211, 0.070 and 0.070, respectively.

Numerical and experimental analysis is performed to examine flows around a rotating disk with finite thickness in a cylindrical enclosure. Figure 1 shows the flow patterns near the stationary end wall of enclosure. As the Reynolds number based on the circumferential velocity at the disk rim increases, the flows develop from those with circular rolls to turbulent spiral flows. The flow in Fig. 2 remains steady and it has a large vortex in the gap between the rotating disk and the shroud of the enclosure, while it is axisymmetric around the rotating axis. This result shows one of the evidences given by the complexity in nonlinear systems. The steady flow which is axisymmetric but is not symmetric in the axial direction has also been found in Taylor-Couette system with very small aspect ratio.