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Hysteresis Behavior of Large Scale Structure in Turbulent Rotating Plane Couette Flow[1] YUHAN HUANG, State Key Laboratory for Turbulence and Complex Systems, College of Engineering, Peking University, Beijing 100871, China, ZHENHUA XIA, Department of Engineering Mechanics, Zhejiang University, Hangzhou 310027, China, MINPING WAN, SHIYI CHEN, Department of Mechanics and Aerospace Engineering, Southern University of Science and Technology, Shenzhen 518055, China — The existence of counter rotating vortex pairs is important in rotating plane Couette flow (RPCF). Two groups of numerical simulation were conducted with rotation number, Ro ($Ro = 2\Omega h/U_w$, with Ω being the constant angular velocity in the spanwise direction, h being half channel height and U_w being half wall velocity difference), varying between 0.01 and 0.6. We found that the number of vortex pairs in a finite computation domain exhibits a hysteretic behavior as Ro increases and decreases. When Ro increases from 0.03 to 0.3, the number of vortex pairs is 2. When Ro decreases from 0.3 to 0.03, the number of vortex pairs is 3. This phenomenon is related to multiple states in RPCF or state bifurcation. Turbulent statistics such as friction, turbulent kinetic energy also form hysteresis loops. A linear stability analysis is performed on this problem to explain the formation of the hysteresis behavior.

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