Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

DNS study on the turbulence statistics of the Taylor-Couette flow in the Reynolds numbers near the torque transition KOUSUKE OSAWA, YOSHITSUGU NAKA, Tokyo Institute of Technology, NAOYA FUKUSHIMA, The University of Tokyo, MASAYASU SHIMURA, MAMORU TANAHASHI, Tokyo Institute of Technology — The Taylor-Couette flow has been investigated extensively because of its significance in a wide range of engineering applications. In the present study, direct numerical simulations (DNS) have been performed to clarify the characteristics of turbulence statistics of Taylor-Couette flow in Re from 8000 to 20000 where the torque scaling changes according to the Wendt's empirical formula. Although the flow structures show the existence of the Taylor vortex, the fine scale structures become more pronounced in higher Reynolds numbers. The velocity fluctuations are decomposed into the contribution of Taylor vortex and the remaining turbulent component. A distinct Reynolds number dependence is observed for the turbulence components in the circumferential velocity fluctuation and the Reynolds shear stress while those of the wall normal and the axial velocity fluctuations are insensitive to the Reynolds number change. The budget of the transport equation of the Reynolds stress is evaluated, and the balance of the Reynolds shear stress indicates the Reynolds number dependence in the redistribution and pressure-diffusion terms. This may explain the Reynolds number dependence in the relative contribution of the Taylor vortex and the turbulence components of the Reynolds shear stress.

Yoshitsugu Naka
Tokyo Institute of Technology

Date submitted: 01 Aug 2014 Electronic form version 1.4