Numerical Investigation of Open and Closed Von Krmn Flow[1]

NIDHI SHARMA, JOSHUA R. BRINKERHOFF, University of British Columbia
Okanagan — Direct numerical simulations of flow between two counter-rotating
coaxial disks with and without cylindrical side walls are carried out to investigate the
developed turbulent swirling flow. The developed von Kármán flow when enclosed
within a cylinder is defined as the closed von Kármán flow and without cylindrical
side walls as open von Kármán flow. The validation study carried out for the smooth
flat disks for high radius to height ratio, shows good comparison with the results
reported in Gauthier *et al.*[2]. For high value of Reynolds number of the top disk,
(Re_t), the flow shows the formation of negative spirals extending from the periphery
of the disks to the center. On increasing the value of Re_t, only positive spirals
are observed. From the radial, tangential and axial components of velocity field,
high radial and axial bulk flow is noticed for open von Kármán flow. The vortex
extraction method of Q-criteria shows strong and stable vortical structures formed
at intermediate times, existing up to later times. The impact of coherent structures
on the turbulent kinetic energy budget is ascertained. Grid convergence study is
performed using three refined grids.

[2]G. Gauthier et al., **J.Fluid Mech.** 121, 473, (2002)

Nidhi Sharma
University of British Columbia Okanagan

Date submitted: 10 Aug 2020   Electronic form version 1.4