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Influence of Rotation Number to Coherent Structures and Torque Scaling in Turbulent Taylor-Couette Flow[1] SEDAT TOKGOZ, LaVision GmbH/TU Delft, GERRIT ELSINGA, RENE DELFOS, JERRY WESTERWEEL, TU Delft — Flow between two coaxial cylinders is called Taylor-Couette flow and has been studied extensively over the years. Due to the closed and well controlled character of the system, experimental studies with different measurement techniques mostly focused on the turbulent flow. Torque measurements performed at the turbulent range of Reynolds numbers showed change of the torque scaling with relative rotation speeds of the cylinders (i.e. rotation number). In this study, we use tomographic PIV to capture instantaneous three-dimensional flow structures in turbulent Taylor-Couette flow in order to study the mechanism that is responsible for the change of the torque. Time-averaging and auto-correlation of the data confirm the change of coherent structures with the rotation number in the mean flow. Spatial filtering of the instantaneous vector fields enables separating the contributions of small and large scale motions to the Reynolds stress. We show that combination of large scale azimuthal-small scale radial and large scale azimuthal-large scale radial motions are the dominant ones that are effecting the torque. Additionally, we observe change of the organisation of the coherent large scale structures with the rotation number, in relation to the change of the torque scaling.

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Sedat Tokgoz
LaVision GmbH/TU Delft

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