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Routes to turbulence in the rotating disk boundary-layer of a rotor-stator cavity EUNOK YIM, ERIC SERRE, DENIS MARTINAND, Aix-Marseille Universite, CNRS, Ecole Centrale Marseille, Laboratoire M2P2 UMR 7340, Marseille, France, JEAN-MARC CHOMAZ, LadHyX, CNRS, Ecole polytechnique, Palaiseau, France — The rotating disk is an important classical problem, due to the similarities between the 3D boundary layers on a disk and a swept aircraft wing. It is nowadays admitted that a direct transition to turbulence may exist through a steep-fronted nonlinear global mode located at the boundary between the locally connectively and absolutely unstable regions (Pier 2003; Viaud et al. 2008, 2011; Imayama et al. 2014 and others). However, recent studies (Healey 2010; Harris et al. 2012; Imayama et al. 2013) suggest that there may be an alternative route starting at lower critical Reynolds number, based on convective travelling waves but this scenario is still not fully validated and proven. To better characterize such transition, direct numerical simulations are performed in a closed cylindrical rotor-stator cavity (without hub) up to $Re = O(10^5)$. All boundaries are no slip and for the stable region around the rotation axis prevents the disturbances coming from the very unstable stator boundary to disturb the rotor boundary layer. Different transition scenarii to turbulence are investigated when the rotor boundary layer is forced at different positions and forcing amplitude. The associated dynamics of coherent structures in various flow regions are also investigated when increasing Re.

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