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Primary instabilities in the rotating-disk boundary-layer flow ELLINOR APPELQUIST, PHILIPP SCHLATTER, P. HENRIK ALFREDSSON, Kungliga Tekniska Hogskolan KTH, R.J. LINGWOOD, Queen Mary University of London — For the flow over a rotating disk, also called the von Kármán flow, there is an exact similarity solution to the Navier–Stokes equations (NSE). This solution is open to a theoretical analysis and there are two types of instabilities present in the flow, convective and an absolute instability.[1] The primary convective instability is of the same type as the instabilities one finds on a swept wing, called the crossflow instability. Here the development of this flow is investigated by direct numerical simulations (DNS) using both the linearised and fully nonlinear NSE. The main goal is to map out the instabilities and structures in the flow to investigate how the flow becomes turbulent. Linear simulations are already finalized,[2] and further non-linear simulations allow investigation of the transition to turbulence of the realistic spatially-developing boundary layer, and these simulations can be directly compared with physical experiments of the same case. However, in contrast to experiments, the DNS provides an opportunity to eliminate certain instabilities in the flow field such that other instabilities can be investigated separately.

[1]Lingwood, R. *J. Fluid. Mech.* **299**, 1995
[2]Appelquist, E., et al. *J. Fluid. Mech.* **765**, 2015

Ellinor Appelquist
Kungliga Tekniska Hogskolan KTH

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