

5. Vortex breakdown

Numerical prediction of vortex breakdown

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Abstract. Despite of numerous publications on breakdown, the essential details of the problem could not sufficiently be clarified in the sense that prediction of such flows can be made. While earlier investigations tried to establish criteria according to which it could be decided, whether breakdown would occur or not, more recent analyses mainly employ numerical integration techniques with the aim of predicting the flow. In particular, two approaches were used in recent investigations: One is the slender-vortex approximation, in which the conservation equations are simplified in the spirit of the boundary-layer theory, and the other relies on the solution of the Navier–Stokes equations. Both approaches are briefly reviewed in this paper, together with some of the important results. It is clear that because of the limited length of the paper, no details of the analysis can be given. The slender-vortex approximation and its extension to compressible flow will be discussed first. Thereafter some results will be reported on the numerical solution of the Navier-Stokes equations.