INFLUENCE OF REYNOLDS NUMBER ON THEORETICAL MODELS FOR TRAILING VORTICES

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Abstract We conduct direct numerical simulations for a NACA0012 airfoil at Reynolds numbers (Re) ranging from 300 to 7000 to determine the wake behavior behind this wing profile. We characterize the structure of the wing-tip vortex, finding a reasonable agreement with experimental results at Re=7000. In addition, we model the trailing vortex theoretically [1], thus obtaining the parameters for Batchelor's [2] (see figure 1) and Moore and Saffman's models [3]. We compare the results of the best fitting for the axial vorticity and the azimuthal velocity, finding only small discrepancies. The main contribution of this research work is to study the evolution of these theoretical parameters as function of the Reynolds number. We observe that the wake becomes unstable at $Re \approx$1200, in agreement with previous results [4]. These instabilities in the wake behind the wing produce a change in the trend of theoretical parameters (keywords: vortex dynamics, trailing vortices, theoretical models).

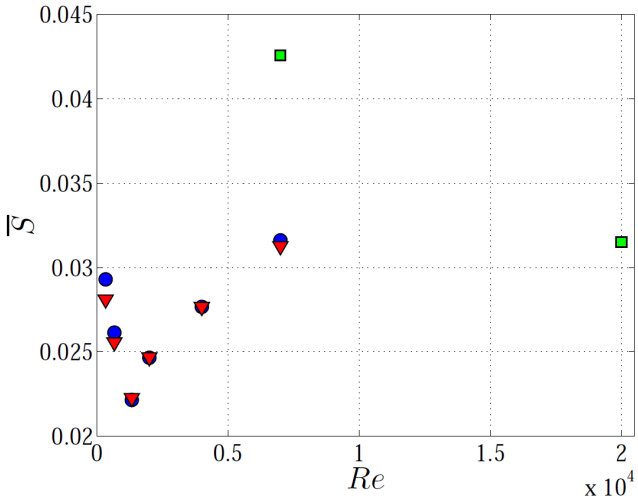

Figure 1. Theoretical parameter $\overline{S}$ of Batchelor's model as function of Reynolds number. Best fitting for axial vorticity (triangles), azimuthal velocimetry (circles) and experimental data (squares).

References

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