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Evolution of vortex-surface fields in the flow past a finite plate WENWEN TONG, YUE YANG, College of Engineering, Peking University — We investigate the evolution of the vortex-surface field (VSF) in the three-dimensional flow past a finite plate at the Reynolds number of 300, aspect ratio of 2, and angle of attack of 30 degrees. The VSF method is extended to complex flows with an immersed boundary by adding a source term in the VSF evolution equation. The VSF isosurfaces display that near-plate vortex surfaces first roll up from plate edges, and then form hairpin-like structures near the leading edge and semi-ring structures near plate tips and in the wake. We quantitatively distinguish two types of vortical structures by null points of streamwise vorticity on VSF isosurfaces, and refer them to as the leading edge vortex (LEV) and tip vortex (TIV). The VSF characterizes that the development of the LEV near tips is suppressed by the finite growth of TIV. In the wake region, helical vortex lines are generated and their geometry and impulses are quantified based on the VSF isosurfaces for TIV.

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