## 2<sup>nd</sup> International Conference on

## Fluid Dynamics & Aerodynamics

October 19-20, 2017 | Rome, Italy

## Vortex force approach for general airfoils of compressible flow

Juan Li, Chen-Yuan Bai Zi-Jun Chen and Zi Niu Wu Tsinghua University, China

Recently, we have proposed a vortex force method for a flat plate at large angle of attack for incompressible flow (Li & Wu 2016). A vortex force line map is built to identify the contribution to aerodynamic force of each given potential free vortex. Combined with Computational Fluid Dynamics (CFD) simulation and the pressure distribution analysis, we decompose the force variation in time into four repeatable stages: the force release stage, force enhancement stage, stall stage and the force recovery stage. The four force stage is closely related to the vortex structure in the flow field: (1) the force enhancement is due to the leading edge suction force caused by the building and the early motion of a leading edge vortex (LEV); (2) stall is due to the high up-wash effect caused by the newly generated trailing edge vortex (TEV) downstream and close to the trailing edge; (3) the force recovery is due to the trailing edge suction force caused by the force is released. The above research is just for the flat plate and for incompressible flow. Here we extend the vortex force approach proposed for flat plate and incompressible flow to general airfoils and for subsonic compressible flow using the integral force approach by Howe (Howe 1995). Both the simple Prandtl-Glauert compressible correction and the correction by the local density are considered. And the CFD simulation is used for verification of our vortex force method.

li-juan13@mails.tsinghua.edu.cn

Notes: