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Vorticity forces on an impulsively started finite plate¹ CHIN-CHOU CHU, CHENG-TA HSIEH, JIAN-JHIH LEE, CHIEN CHENG CHANG, National Taiwan University — In this talk, various force contributions to an impulsively started finite plate with a high and low aspect ratio are investigated from the perspective of a diagnostic vorticity force theory. In contrasted to the traditional pressure force analysis (PFA), the vorticity force analysis (VFA) reveals new salient features in its applications to three-dimensional flow by examining section-wise force contributions along the spanwise direction. At a large aspect ratio ($AR=3$), the force distributions of PFA and VFA show close agreements with each other in middle sections, while at a lower aspect ratio ($AR=1$), the force distribution of PFA is substantially larger than that of VFA in most of the sections. The difference is compensated by the contributions partly by the edge sections and mainly by the outer tip vortices. The present force-element analysis provides a better perspective for flow control by relating the forces directly to the various sources of vorticity (or vortex structures) in the flow.

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