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Modeling intermittent leading-edge vortex shedding in unsteady airfoil flows with reduced-count discrete vortices[1] ASHOK GOPALARATHNAM, North Carolina State University, KIRAN RAMESH, University of Glasgow, UK, ARUN VISHNU SURESH BABU, North Carolina State University — A discrete-vortex method for unsteady airfoil flows with intermittent leading-edge vortex (LEV) shedding was proposed by Ramesh et al (JFM, 2014). Two novelties were introduced: (i) LEV shedding is initiated using discrete vortices whenever the Leading Edge Suction Parameter (LESP), which is a measure of leading-edge suction, exceeds a critical value, and (ii) the strength of the discrete vortices is determined such that the LESP maintained at the critical value during the shedding process. Although results from this low-order method agree with CFD and experiments, the increasing vortex count with time increases the computational cost. The large number of shed vortices from the TE can be reduced through traditional techniques such as amalgamation and deletion, as they typically convect away from the airfoil and interact only weakly with the airfoil vorticity. The LEV, on the other hand, interacts strongly with the airfoil, and has a large influence on the forces. An approach to reduce the vortex count is desired. Inspired by Wang and Eldredge (TCFD, 2013), we propose a model that has just a single vortex to model an active LEV. The varying strength of this free vortex is determined using our LESP criterion. Results from the method for unsteady airfoil motions are promising.

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