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Reduced-order aeroelastic model for limit-cycle oscillations in vortex-dominated unsteady airfoil flows ARUN VISHNU SURESH BABU, North Carolina State University, KIRAN RAMESH, University of Glasgow, ASHOK GOPALARATHNAM, North Carolina State University — In previous research, Ramesh et al (JFM,2014) developed a low-order discrete vortex method for modeling unsteady airfoil flows with intermittent leading edge vortex (LEV) shedding using a leading edge suction parameter (LESP). LEV shedding is initiated using discrete vortices (DVs) whenever the Leading Edge Suction Parameter (LESP) exceeds a critical value. In subsequent research, the method was successfully employed by Ramesh et al (JFS, 2015) to predict aeroelastic limit-cycle oscillations in airfoil flows dominated by intermittent LEV shedding. When applied to flows that require large number of time steps, the computational cost increases due to the increasing vortex count. In this research, we apply an amalgamation strategy to actively control the DV count, and thereby reduce simulation time. A pair each of LEVs and TEVs are amalgamated at every time step. The ideal pairs for amalgamation are identified based on the requirement that the flowfield in the vicinity of the airfoil is least affected (Spalart, 1988). Instead of placing the amalgamated vortex at the centroid, we place it at an optimal location to ensure that the leading-edge suction and the airfoil bound circulation are conserved. Results of the initial study are promising.

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