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ON THE EVALUATION OF DIFFERENT PROCEDURES FOR COMPUTING AERODYNAMIC LOADS FOR THE UNSTEADY VORTEX LATTICE METHOD

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Abstract. The unsteady vortex-lattice method (UVLM) is widely used to estimate the aerodynamic loads for unsteady subsonic flows. The approach is well-suited for applications where the free-wake modeling becomes critical, for example hovering rotors, wind turbine blades, flapping wings and flexible aircraft. Several procedures have been proposed in the literature for computing aerodynamic loads for the UVLM. In this paper we present a comparative evaluation among three such techniques: the Joukowski method, the Katz method and a modified version of the Katz method developed at Virginia Tech. The methodology used to evaluate the quality of the predictions of the aforementioned methods consists in a convergence analysis of the aerodynamic loads (lift and induced drag) for a lifting surface undergoing pitching and plunging motions. In addition, the authors provide: *i*) a detailed description of the theoretical aspects of each one of the methods; *ii*) a detailed description of the computational implementation; and *iii*) a detailed analysis of the computational cost. All methods are implemented in a single Fortran code. The numerical results obtained using the code present good agreement with known solutions found in the literature for two-dimensional airfoils and three-dimensional wings in steady and unsteady flows cases.