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Numerical Investigations on Dynamic Stall of a Pitching-Plunging Helicopter Blade Airfoil

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Abstract : Effect of plunging motion on the pitch oscillating NACA0012 airfoil is investigated using computational fluid dynamics (CFD). A simulation model based on overset grid technology and k - ω shear stress transport (SST) turbulence model is established, and the numerical simulation results are compared with available experimental data and other simulations. Two cases of phase angle φ = 0, μ which represents the phase difference between the pitching and plunging motions of an airfoil are performed. Airfoil vortex generation, moving, and shedding are discussed in detail. Good agreements have been achieved with the available literature. The upward plunging motion made the equivalent angle of attack less than the actual one during pitching analysis. It is observed that the formation of the stall vortex is suppressed, resulting in a decrease in the lift coefficient and a delay of the stall angle. However, the downward plunging motion made the equivalent angle of attack higher the actual one.

Keywords : dynamic stall, pitching-plunging, computational fluid dynamics, helicopter blade rotor, airfoil
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