Abstract Submitted
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Dynamic stall characteristics of a pitching airfoil with an oscillating trailing-edge flap[1] GUOSHENG HE, Ecole Polytechnique Federale de Lausanne, Switzerland, LARS SIEGEL, ARNE HENNING, KAREN MULLENERS, German Aerospace Center, Gttingen, Germany — The formation and growth of the dynamic stall vortex lead to a time delay with respect to static stall, to higher maximum lift, and larger load fluctuations. Here, we study the influence of the pitching frequency of the main airfoil and of an oscillating trailing-edge flap on the dynamic stall development and delay. We measured the unsteady surface pressure around the airfoil, and calculated the leading edge suction parameter by integrating the pressure distribution in the front 10% of the airfoil. The stall delay reduces with increasing airfoil pitching frequency. The flap oscillation has a smaller influence on the stall delay than the airfoil pitching frequency. The stall delay decreases when the flap oscillation is leading the main airfoil oscillation and the stall delay increases when the flap motion is lagging the main airfoil. The lift, however, is significantly affected by the flap oscillation which leads to large variations of effective angle of attack. Higher pre-stall effective angles of attack, which occur for a leading flap motion, yield higher maximum lift and vice versa. A flap phase shift changes the dynamic stall lift characteristics significantly but it only slightly alters the stall delay. The stall delay is dominated by the main airfoil pitching frequency.

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