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Titel des Beitrags:
Fluid-Structure interaction analysis and performance evaluation of a membrane blade

Abstract:
Examining the potential of a membrane blade concept is the goal of the current work. In the sailwing concept the surface of the wing, or the blade in this case, is made from pre-tensioned membranes which meet at the pre-tensioned edge cable at the trailing edge. Because of the dependency between membrane deformation and applied aerodynamic load, two-way coupled fluid-structure interaction analysis is necessary for evaluation of the aerodynamic performance of such a configuration. The in-house finite element based structural solver, CARAT++, is coupled with OpenFOAM in order to tackle the multi-physics problem. The main aerodynamic characteristics of the membrane blade including lift coefficient, drag coefficient and lift to drag ratio are compared with its rigid counterpart. A single non-rotating NREL phase VI blade is studied here as a first step towards analyzing the concept for the rotating case. Compared with the rigid blade, the membrane blade has a higher slope of the lift curve. For higher angles of attack, lift and drag coefficients as well as the lift to drag ratio is higher for the membrane blade. A single non-rotating blade is studied here as a first step towards analyzing the concept for the rotating case.

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