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Comparative Study of Airfoil Flow Separation Criteria NICK LAWS, WAAD KAHOULI, BRENDEN EPPS, Thayer School of Engineering, Dartmouth College — Airfoil flow separation impacts a multitude of applications including turbomachinery, wind turbines, and bio-inspired micro-aerial vehicles. In order to achieve maximum performance, some devices operate near the edge of flow separation, and others use dynamic flow separation advantageously. Numerous criteria exist for predicting the onset of airfoil flow separation. This talk presents a comparative study of a number of such criteria, with emphasis paid to speed and accuracy of the calculations. We evaluate the criteria using a two-dimensional unsteady vortex lattice method, which allows for rapid analysis (on the order of seconds instead of days for a full Navier-Stokes solution) and design of optimal airfoil geometry and kinematics. Furthermore, dynamic analyses permit evaluation of dynamic stall conditions for enhanced lift via leading edge vortex shedding, commonly present in small flapping-wing flyers such as the bumblebee and hummingbird.

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