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Analysis of the cycle-to-cycle pressure distribution variations in dynamic stall[1] TANNER HARMS, POURYA NIKOUEEYAN, JONATHAN NAUGHTON, University of Wyoming — Dynamic stall is an unsteady flow phenomenon observed on blades and wings that, despite decades of focused study, remains a challenging problem for rotorcraft and wind turbine applications. Traditionally, dynamic stall has been studied on pitch-oscillating airfoils by measuring the unsteady pressure distribution that is phase-averaged, by which the typical flow pattern may be observed and quantified. In cases where light to deep dynamic stall are observed, pressure distributions with high levels of variance are present in regions of separation. It was recently observed that, under certain conditions, this scatter may be the result of a two-state flow solution as if there were a bifurcation in the unsteady pressure distribution behavior on the suction side of the airfoil. This is significant since phase-averaged dynamic stall data are often used to tune dynamic stall models and for validation of simulations of dynamic stall. In order to better understand this phenomenon, statistical analysis of the pressure data using probability density functions (PDFs) and other statistical approaches has been carried out for the SC 1094R8, DU97-W-300, and NACA 0015 airfoil geometries.

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Jonathan Naughton
University of Wyoming

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