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A statistical approach characterizing the effectiveness of flow control on a dynamically pitching airfoil KEITH TAYLOR, MICHAEL AMITAY, Rensselaer Polytech Inst — The presence of dynamic stall on wind turbines complicates the goal of energy production, as variations in input loading runs counter to the end goal of producing continuous level power output from a wind turbine. While dynamic stall has been extensively studied experimentally and computationally, the control of dynamic stall through active flow control is still a nascent field of research. In order to understand the flow field around a dynamically pitching finite span airfoil, a new method of characterizing the effectiveness of flow control in a statistical sense is presented. This method leverages the gamma one criterion on Particle Image Velocimetry images to identify the vortices shed, then statistically describes how the distribution of the circulation strength of identified vortices changes during dynamic stall. This is in contrast to previous work, which only addressed the phase averaged flow field, which does not fully illustrate how the flow field varies loop by loop, as there is significant variation between phase averaged flow fields and instantaneous flow fields measured. The purpose of this work is to present a new method of characterizing the effectiveness of flow control under dynamic conditions, without the need to capture PIV at high frequencies.

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