POD & MLSM Application on DU96-W180 Wind Turbine Airfoil

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Abstract: *In this study, the aim was to reduce the complexity of the costly non-linear unsteady partial differential equations governing the aerodynamic flows into a simpler lower-dimensional model. Modal decomposition method; namely Proper Orthogonal Decomposition (POD) was applied in conjunction with the Modified Linear Stochastic Measurement (MLSM) to achieve a reduced order model with high accuracy and low computational cost. The methods were applied to the surface pressure values of a DU96-W180 Wind Turbine Airfoil with emphasis on stall control application. It was found that using only 3 POD modes, most of the system energy (up to 99%) was captured where the reconstructed pressure distribution matched the CFD one obtained from OpenFOAM simulations. Besides, using only two pressure probes, one upstream and the other downstream, the surface pressure field was reconstructed with high accuracy. This application is important in reducing the computational time form several hours to just few seconds for applications involving recursive solution of the Navier-Stokes equations.*

Keywords: POD; MLSM; CFD; OpenFOAM.