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Aerodynamics of S809 Airfoil at Low and Transitional Reynolds Numbers JAIME J. CARRERAS, Universidad del TuraboTexas Tech University, NADER LAAL-DEHGHANI, SERDAR GORUMLU, FARAZ MEHDI, LUCIANO CASTILLO, BURAK AKSAK, JIAN SHENG, Texas Tech University — The S809 is a thick airfoil extensively used in wind turbine design applications and model studies in wind tunnel. With increased interests in reducing energy production cost and understanding turbulence and turbine interactions, scaled down models (Re$\sim 10^3$) are often used as an alternative to full scale field experimentation (Re $> 10^6$). This Reynolds number discrepancy raises the issue of scaling for the airfoil performance from laboratory studies to field scale applications. To the best of our knowledge, there are no studies existing in literature to characterize the lift- and drag-coefficients of S809 airfoil at Re less than 3×10^5. This study is to fill the deficit in the current state of knowledge by performing high resolution force measurements. The lift and drag measurements are carried out in Texas Tech Wind Tunnel Facility using an in-house developed dual-cell force balance. The configuration eliminates the large torque and torsion often accompanied by conventional mounts. This unique design allows us to reach a measurement accuracy of 0.02N (0.1%). Comparative studies are performed on a two-dimensional airfoil with a smooth- as well as a well-engineered surface covered by micro-pillar array to simulate the surface conditions of a real life airfoil.

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