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Corotating Vortex Formation, Merger, and Modification JAMEY JACOB, University of Kentucky — Experimental results from a combined wind tunnel and tow tank study on the evolution, interaction, and merger of two corotating trailing vortices are presented. In the current study, NACA 0012 airfoils positioned at positive and negative angles of attack are used to generate a corotating vortex pair. Measurements with a seven-hole probe are used to extract 3-D velocity and pressure fields in the tunnel while PIV is used in the tow tank to measure 2-D velocity fields in the vortex wake. The semi-span length is varied in the experiments to investigate the effects of initial separation on vortex formation and merger. Experimental information of the vortex motion is compared with theoretical predictions. Comparison shows that at larger initial separations, the motion of the vortex pair is well estimated from the 2-D analysis, while at smaller separations, the motion of the vortex pair cannot be well predicted from the results of the line vortex assumption. Effects in forcing vortex breakup using a virtual winglet from a plasma actuator are presented. At sufficient power inputs, the virtual winglet can substantially modify the vortex circulation magnitude and distribution. Comparisons of information confidence and data quality are made between the two measurement techniques and facilities. Finally, comparisons of differences in the vortex roll-up and evolution due to initial separation changes are discussed and contrasted to that of a single tip vortex and corotating vortex pair on a wing with flap.

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