Reducing Wingtip Vortex by Adjusting Wingtip Angle: Experimental and Computational Analysis

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In aviation, the common problem that reduces the efficiency of an aircraft wings is wingtip vortex because it can reduce lift and increase drag. The attachment of wingtip can reduce the usage of fuel if the angle of wingtip can be adjusted to the angle of attack. The purpose of this research is to investigate the highest coefficient of performance (COP) in certain wingtip angle and angle of attack (AOA) to reduce wingtip vortex using validation methods of computational fluid dynamics and experimental. For experimental method, the model is scaled into 1:84 ratio and 3D-printed using Acrylonitrile Butadiene Styrene (ABS) polymer. Next, the prototype is attached to load cell FUTEK LSB300. Then, the prototype is tested on Educational Small Wind Tunnel to validate computational data. The computational method is done using the same prototype model and material. The prototype is tested using the same domain and parameters as the experimental did. The testing is done using SolidWorks CFD Program. Both methods show identical trendline, which when the airspeed is increased, the COP will also increase for all experiments. The results show that in 30˚ AOA, the highest COP reaches 2.05 in experimental and 1.59 in computational with 45˚ wingtip angle and airspeed of 25 m/s. Other results show that in 0˚ AOA, the highest COP is 3.34 in computational method using 0˚ wingtip angle and 6.02 in experimental method using 45˚ wingtip angle and airspeed of 25 m/s. The difference is caused due to inconsistency of experimental parameter. This research can be concluded that by changing the wingtip angle on certain angle of attack, wingtip vortex can be reduced which is indicated from increase in COP. Keywords: Wingtip Vortex, Computational Fluid Dynamics, Coefficient of Performance.