



**AERODYNAMICS PERFORMANCE OF OPTIMAL  
WING PROFILE ON MAV WINGS**

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“I declared that this thesis is the result of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any degree.”

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## ABSTRACT

The optimum design for Micro Air Vehicle (MAV) fixed wing is Zimmerman based on the optimal efficiency, however, the effect of camber to aerodynamics performance on the Zimmerman design are not fully discovered by previous researchers due to wide range of airfoil profile. Thus, the objectives of this research are to compare the aerodynamics performance of Zimmerman wing design with different percentage of camber. Three types of Zimmerman wing design known as Profile 1, Profile 2 and Profile 3 with 3%, 6% and 12% of camber, respectively which has different polynomial equation are used for ANSYS-CFX simulations. The three types of wing are initially developed by using ANSYS-Design Modeler before the aerodynamic simulation executed based on ANSYS-CFX simulation. The results shows that the stall angle of attack (AOA) for Profile 2 is  $35^\circ$  which is  $3^\circ$  and  $5^\circ$  higher than Profile 1 and Profile 3, respectively. The maximum lift coefficient ( $C_{L_{max}}$ ) results shows that Profile 3 has better  $C_{L_{max}}$  at 179.19% and 22.89% higher than Profile 1 and Profile 2, respectively. Based on the minimum drag coefficient ( $C_{D_{min}}$ ) analysis, all three profile produce  $C_{D_{min}}$  at  $AOA \approx 0^\circ$ . However, at this stage, Profile 1 produce the lowest  $C_{D_{min}}$  at 99.6% and 99.9% lower than Profile 2 and Profile 3, respectively. The moment coefficient analysis shows that Profile 3 shows the steepest curve slope at  $\Delta C_L / \Delta C_M$  which is 22% and 35.32% higher than Profile 2 and Profile 1, respectively. Based on aerodynamic efficiency ( $C_L / C_D$ ) study, Profile 2 shows the highest  $C_L / C_D$  value at 10.1175 which is higher about 23.38%

and 173.1% than Profile 1 and Profile 3, respectively. In conclusion, one can presume that Profile 2 produce better  $C_L$ ,  $C_D$ ,  $C_M$  and  $C_L/C_D$  distribution.