AERODYNAMIC PERFORMANCE OF MAV WING WITH FUSELAGE AND STABILIZER

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DECLARATION

I hereby declare that the thesis report entitled “Aerodynamic Performance of MAV with Fuselage and Stabilizer” written and submitted by me to Universiti Teknologi MARA (UiTM) Pulau Pinang in partial fulfillment of the requirement awarding the Degree of Mechanical Engineering (Manufacturing) (hons). This thesis is my original work and the only author of this thesis. I also declare that neither the whole work nor any part of it has been, is being, or is to be summited or published to any other university or institutions.

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CERTIFICATION

"I declared that I read this thesis and in our point of view this thesis is qualified in term of scope and quality for the purpose of awarding the Degree of Mechanical Engineering (Manufacturing) (hons)"

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ABSTRACT

The history of micro air vehicles (MAVs) really began with the development of model airplanes in the 19th century. However, the study of micro air vehicles (MAVs) is currently lack with the understanding of aerodynamics for the small aircraft flying at low speeds. Based on previous findings, the study on Zimmerman and Inverse Zimmerman wings had only focus on the wing performances rather than a complete MAV configuration, which exclude the fuselage and stabilizer components. Thus, the objective of current study is to find the discrepancy in aerodynamic performances between the MAV wing by including the fuselage and stabilizer components. In this study, the Zimmerman and Inverse Zimmerman wing with fuselage and stabilizer configuration is known as ZWFS and IZWFS, respectively. While the wing only configurations (without fuselage and stabilizer) are known as ZW and IZW. In the present research, CFX simulation method is used to study the performance on all wings. To solve the turbulent flow issue, 3D RANS equations coupled with SST k-ω turbulent equation are employed in the simulation works. Based on the simulation results, the wing only configurations (ZW and IZW) induce higher C_L magnitude (between 42%-61%) compared to wing-fuselage configuration (ZWFS and IZWFS). However in C_D performance, ZW induced better C_D distribution than others configuration. The fuselage and stabilizer components induced a slight disadvantage (about 12.4%) in overall C_D distribution. In C_M performances, IZWFS have better C_M than IZW by 0.54% which indicates that the wing with fuselage and stabilizer induced better stability. Moreover, in C_L/C_D analysis, the result shows that the wing only configuration (ZW and IZW) have better C_L/C_D distribution (between 39%-52%) compared to IZWFS and ZWFS. The TV studies also reveal that the benevolent C_D performance on IZWFS is due to larger TV formations found on the wing. While, the low pressure distribution (C_P) study reveals that IZW have more concentrated $-C_{pmin}$ at the wing tips of the design which make IZW have better C_L performance than ZW, ZWFS and IZWFS.