



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS**

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SHORT ABSTRACT

Fluid flow, particularly in aerodynamics, has long been a complex area of study. Most aerodynamic research has focused on Reynolds numbers (Re) around 10^6 , relevant to commercial airliners, leading to highly optimized wing designs for that regime. However, these designs are not directly applicable at lower Re (10^4 – 10^6), typically seen in Micro Aerial Vehicles (MAVs) and micro wind turbines, where size constraints limit performance gains. Experimental studies have shown that at low Re , simply scaling down conventional wings does not replicate performance. Interestingly, flat-plates can outperform streamlined airfoils in terms of lift-to-drag ratio (L/D), often providing a more stable L/D below Re 10^6 . This is attributed to differences in flow separation and laminar separation bubble behavior, where initiating transition to turbulence can be beneficial. Wind tunnel experiments were conducted on flat-plates with various aspect ratios, incorporating inverted dimples to promote transition and improve lift. Inspired by bird wing-tip feathers, further modifications aimed to enhance lift without significantly increasing drag. With advances in technology and growing MAV applications, flat-plates show promising potential as efficient, simple lift-generating surfaces for low- Re flow.