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NUMERICAL ANALYSIS OF GROUND EFFECT INTERACTION FOR ROTATIONAL SYSTEMS IN MARTIAN ATMOSPHERE

Abstract

"You could warm up Mars, overtime, with greenhouse gases" as quoted by Elon Musk, Mars as the very next planet to be adroitly explored by mankind, a bounded outstretch over the surface has been achieved with rovers and the Ingenuity Mars helicopter in the contemporary times. However, the thin Martian atmosphere poses challenges for heavier-than-air flight. Leveraging ground effect to minimize external lift requirements, a hovering system can effectively navigate the terrain at a safe altitude with focus on efficiency in view of Martian surface area to time. While, performance of ariel vehicles within the surface vicinity is dominated by ground interaction, an computer based model is geared supporting the performance of the same with action of ground effect, the employed numerical model in the study elucidates the interaction between rotational wings and ground effect with Iterative analyses conducted using quantified Martian atmospheric conditions in a chamber modelled in Autodesk Fusion 360 and simulated with numerical solvers in COMSOL Multiphysics. An ongoing investigation into the interplay of ground effect with the support of lighter-than-air vehicles on Mars presents a pioneering frontier for future Martian flights. This exploration encompasses the analysis of flow structures and the resultant pressure gradients, promising to unlock a multitude of opportunities in Martian exploration.