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ADAPTATIVE FIN STRUCTURES BASED ON TENSEGRITY ACCORDING TO THE DIFFERENT FLIGHT STAGES OF A MODEL ROCKET

Abstract

During a model rocket's flight, the size and shape of the fins have a direct effect on the rocket's necessary aerodynamics to have an optimal displacement prior reaching apogee, giving rise to a stable and controlled trajectory throughout the flight path. However, previous research has established the fact that a fixed frame for the entire course is not the most effective technique due to the different aerodynamic needs of each flight stage. This paper focuses on examining several recommended profiles to create a fin system in such manner that they would be capable of changing their size and shape according to the stage of flight they are in. Therefore to make it a safe, stable, functional and easy-to-manufacture design, flat tensegrity structures are proposed to be used as a way of achieving flights with more aerodynamically favorable results, meeting the end goal of this research. In order to execute this project, mechanical design software and flight simulators are planned to be used with the aim of developing the fin system's blueprint. Hence, its behavior can be visualized and analyzed under specific flight conditions to assess if its configuration meets the appropriate requirements for structural and aerodynamic resistance, therefore the efficiency of the final design gets predicted before being prototyped. Furthermore, tensegrity can be used as a tool to explore new geometries and exploit conventional ones by making changes in stiffness and external shape, thus being an innovative solution with a wide spectrum of applications.