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DEPLOYMENT STRATEGY AND SIMULATION OF AN ADAPTIVE AEROSHELL UNDER VARIOUS SPEED ENVELOPES WITH DISTINCT CONFIGURATION

Abstract

Planetary exploration is becoming a key research area in the field of space exploration to find the possibility of other habitable areas. Exploration rovers like Opportunity, Curiosity and Perseverance are a great milestone in going forward in this area and helping us in understanding the geology and climate of the planet. With the advancement of technology and research aspects, these spacecrafts or rover will be carrying much heavy loads like drill machines or maybe human crew in future. Using an adaptive deployable heat shield will not only help in increasing the payload capacity of spacecrafts but will also accommodate the entire structure in existing payload fairings of launch vehicles. In this research, we are demonstrating an effective deployment technique for an innovative design of an adaptive heat shield, which will work as an aeroshell as well as a nose cone, under speed envelopes of hypersonic and supersonic regimes; in stowed/unstowed conditions as well. The morphed structure will be deployed using pneumatics/actuators controlled by electronic circuits. The installed sensors will supply the input value of instantaneous speed and dynamic pressure values to electronic circuit which will be directing the actuating mechanism to deploy the adaptive heat shield according to the defined state. The simulations and graphs of this deployment strategy are hence presented. This idea will improve the deployment strategy and can be further used for spacecrafts in futuristic human crew mission to Mars.