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SAFETY FACTOR OF CRITICAL STRUCTURAL COMPONENTS IN GLASS-FIBER REINFORCED PLASTIC SOUNDING ROCKETS

Abstract

During calculation and structural design it is necessary to understand the mechanical properties of the materials used in the construction of a launch vehicle to determine if it is sufficiently safe and resistant to the loads to which it is subjected, which are produced during takeoff, acceleration and decline. Each structural element is subjected to forces such as axial force, normal force, tension, and bending moment. Similarly, the rocket is subjected to high vibrations during flight. The critical components of a rocket are those that, if they fail, compromise the integrity of the launch vehicle. Composite materials are made up of two components, the reinforcement phase and the matrix phase, in the case of Glass-Fiber Reinforced Polymer (GFRP) composites, they are made by combining polymer resin with fibers. These materials show higher resistance to fatigue and longitudinal modulus of elasticity in a ductile matrix. When a fiber-reinforced composite is designed, numerous factors must be considered, including fiber length, diameter, orientation, quantity, and properties, as well as matrix and fiber-matrix bond properties. In rockets, the use of fiberglass and polyester resin is chosen since this composite material is a lightweight material resistant to high temperatures and mechanical forces, as well as having an affordable price, which is why it is currently one of the most the most used materials for the construction of its structure. The structural analysis of this composite material incorporated into sounding rockets is carried out using ANSYS simulations to find out the aerodynamic and structural loads on the components and the safety factors, using CFD (Computational fluid dynamics) and later performing the Finite Element Analysis. (FEA).