

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I Design, Development and Verification (Launch Vehicles and Space Vehicles, including
their Mechanical/Thermal/ Fluidic Systems) (1)

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DESIGN OPTIMIZATION OF SATELLITE PROPELLANT TANK SUBJECTED TO FLUID SLOSH
AND LOADING CONDITIONS

Abstract

Propellant tanks in satellites experience complex scenarios during launch and in-orbit operations from pressure differentials, fluid dynamics and slosh. Pressurized tanks structures require optimized design to withstand these loads. This project focuses on analysis-driven design optimization of propellant tank using SolidWorks tools. The project will involve creating parametric CAD models of tank designs in SolidWorks, incorporating typical geometries, rib patterns and materials used in satellite structures. A coupled fluid-structural simulation will be set up to analyze stresses under pressure loading and propellant slosh loads. Design elements such as material thickness, and rib spacing, will be modified to reduce tank mass while still fulfilling safety factor specifications in the case of coupled pressure-slosh loading scenarios. Through the use of integrated analysis, a final optimum tank design will be proposed. The project will showcase a simulation-based design process utilizing SolidWorks to create lightweight propellant tank that can withstand complicated flight loads. The methods can help optimize the tank to improve structural stability and optimize propellant carrying capacity while keeping mass budgets low.