

NextCovps: Design and Stress Analysis of Dome Composite Overwrapped Pressure Vessels using Geodesic Trajectory Approach

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Abstract : Hydrogen as a sustainable fuel has the highest energy density per mass as compared to conventional non-renewable sources. As the world looks to move towards sustainability, especially in the sectors of aviation and automotive, it becomes important to address the issue of storage of hydrogen as compressed gas in high-pressure tanks. To improve the design for the efficient storage and transportation of Hydrogen, this paper presents the design and stress analysis of Dome Composite Overwrapped Pressure Vessels (COPVs) using the geodesic trajectory approach. The geodesic trajectory approach is used to optimize the dome design, resulting in a lightweight and efficient structure. Python scripting is employed to implement the mathematical modeling of the COPV, and after validating the model by comparison to the published paper, stress analysis is conducted using Abaqus commercial code. The results demonstrate the effectiveness of the geodesic trajectory approach in achieving a lightweight and structurally sound dome design, as well as the accuracy and reliability of the stress analysis using Abaqus commercial code. This study provides insights into the design and analysis of COPVs for aerospace applications, with the potential for further optimization and application in other industries.

Keywords : composite overwrapped pressure vessels, carbon fiber, geodesic trajectory approach, dome design, stress analysis, plugin python

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