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ARTICLE

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CFD STUDIES ON SLOSHING OF LIQUID FUEL IN FUEL TANK UNDER EXTREME DYNAMIC CRASH CONDITIONS

SHAMBHOO YADAV[1]*, MUTHUSELVAN GOVINDARAJ[1],
AND VINAY CHIKKANAYAKANAHALLI ANAND[2]

This study presents a detailed computational fluid dynamics (CFD) analysis of sloshing behavior in aircraft wing tanks under various acceleration conditions. The analysis utilizes the Volume of Fluid (VOF) method with the PRESTO algorithm for decoupling pressure-velocity equations, ensuring stability and accuracy, particularly for flows with sharp gradients. A high grid resolution and small time step are employed to accurately capture complex sloshing behavior. The simulation results are validated against published literature, demonstrating good agreement in terms of pressure amplitude and liquid oscillations and confirming the suitability of the method for sloshing analysis in wing tanks. The load factor values of emergency landing condition, as specified in FAR23, are considered in the present study. The study investigates the effects of different load factor values and acceleration directions on fuel movement and pressure variations in the tank. The results provide insights into fuel behavior under acceleration, which is crucial for designing fuel systems that can withstand forces experienced during flight, especially during emergency landing conditions.

Keywords: *Sloshing, fuel tank, VOF, fluent, unsteady simulation*