Finite element lateral crash analysis of front natural gas vehicle platform with tank mounting structure

ABSTRACT

This article describes the behaviour of a compressed natural gas vehicle (CNGV) front platform assembly subjected to a lateral crash. The platform of a CNGV can be divided into two parts, namely the front and the rear. The rear platform accommodates passenger seats, the fuel tank, luggage and spare tyre. The front platform accommodates the driver and front passenger seats on top. The backbone is a structural member located in the central portion below the front platform stretching from the firewall to the rear platform. For a gasoline vehicle, the exhaust pipe is located underneath the backbone. However, for a CNGV, a cylindrical tank is mounted underneath the backbone by using two mounting structures. The front platform needs to be designed for high stiffness and crashworthiness. The finite element method was used for the analysis. Since the front platform is not in the crumple zone for frontal and rear crashes, only lateral crash is considered. In the analysis, the platform and mounting structures are made of mild steel with Youngôs modulus of 209.0 GPa and Poissonôs ratio of 0.3. The post-yield behaviour is non-linear strain hardening. The tank mounting structure consists of an inverted U channel with two V plates and an upper strip. The ends of the U channel are bolted to the base platform reinforcement. The platform assembly was crashed by a rigid mass of 200.0 kg moving at a speed of 5.0 m sec-1. The crashworthiness parameters considered were crash mode, displacements and energy absorption. The results show that a U channel of width 25.0 mm, height 9.0 mm and thickness 4.0 mm is suitable for the purpose.

Keyword: CNGV; Compressed natural gas vehicle platform; Crashworthiness; Finite element analysis; Lateral impact; Tank mounting structure