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OPTIMAL DESIGN OF AN ANTI-ACCIDENTS VEHICLE-BUFFER

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ABSTRACT

Too many passengers die or injure every year because of highway accidents. Most of the vehicle manufacturing companies are unable successfully to control this matter.

This paper handles the optimal design of a passive spring-damper buffer that can be attached to the vehicle from its front, rear or both sides to avoid catastrophic effects due to collision. The optimization toolbox of MATLAB is used to minimize an absolute error objective function to keep the dynamic motion of the crashing vehicle to below certain level without destroying the standing hit vehicle. A 100 mm level is set for this dynamic motion. The crashing speed is varied between 20 and 140 km/h and a vehicle mass in the range of 1000 to 6000 kg is considered. The required optimal values of the spring stiffness and damper damping ratio are defined against the crashing speed.

The whole process is reduced to the selection of a unit set of buffer parameters to protect crashing small and medium vehicles at speeds ≤ 140 km/h with maximum dynamic motions less that the 100 mm level. This reduces the whole design process to a passive buffer with 88.776 kN/m stiffness and a 2250 kNs/m damping coefficient. This avoids the need to active and semi-active expensive techniques.

KEYWORDS: Highway Accidents, Passive Buffer, Optimal Buffer Design, Semi-Optimal Buffer Design, MATLAB Optimization Application