New restraint concepts for occupant protection in automated vehicle

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Abstract:

The restraint system design for occupant protection becomes a new challenge for a laterally facing seated occupant in an automated driving minivan. This study is to evaluate effectiveness of various new restraint system concepts for occupant protection in frontal, side and rear crash seconarios. The case occupant is a mid-sized male represented by GHBMC M50-OS v1.8.4 human model, positioned in a laterally facing seat in middle of the vehicle. The evaluated restraint concepts include 3-pt seatbelt with dual load-limiter retractor and pretensioners, 4-pt seatbelt, torso restrain airbag (seatbelt integrated), seatmounted far-side airbag, customized head airbag and floor airbag. Multiple loading cases are created for different crash cenarios including the US frontal and oblique NCAP (New Car Assessment Program) tests, pole and MDB (Moving Deformable Barrier) for near and far side, and rear impact. Effectiveness of each restraint system configuration with the new concepts is evaluated for the loading cases respectively. For each case the occupant kinematics is analyzed and the occupant injury measures (OIMs) are obtained. Preliminary optimization of the restraint combinations and design parameters are also performed to mitigate the OIMs. The

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results indicate that a combination of the 3-pt seatbelt and the other new concepts significantly reduce the OIMs over the baseline (the 3-pt seatbelt alone). The torso restrain airbag, seat-mounted far-side airbag, and special head airbag show good benefits. Autonomous vehicle (AV) technology has advanced in quantum leaps in recent years. However, despite all the miles logged by OEM and AV software companies as they put the technology through its paces, accidents occur and will continue to occur. This is especially true because future AVs will share the road with conventional cars for decades to come. There is much to do before the autonomous car is capable of driving more safely than the 'average' human driver and is able to protect the occupants in a crash. A fully autonomous vehicle will remove the duties of driving from human hands. This offers new opportunities for OEMs and Tier 1 suppliers to develop novel seats with the ultimate aim of improving ride comfort and social interaction among occupants. AV concept cars have explored entirely different seating configurations, such as lounge-style setups with rear-facing front rows, diagonal cross-seating, and increased seatback recline angles for a more relaxing ride. These innovative seating positions pose unique challenges when it comes to occupant protection