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New restraint concepts for occupant protection in automated vehicle

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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), seat-mounted 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 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.

Biography

Jay Zhao pursued his PhD from Nanjing University of Science & Technology, P R China; three-years Postgraduate study in City University of New York and Cornell University. Currently he is the Technical Manager of CAE group of Joyson Safety Systems, North America, with 21+ years experience performing CAE analysis for auto restraint components, systems and occupant simuations. He has published more than 40 journal papers or conference presentations and holds two US patents.

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