Investigation of HBM response for relaxed state for the Pre-Crash phase

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Abstract

Crash Investigation in CAE has become more cost-efficient and bio-fidelic with the increasing use of Human body models. With the increasing emphasis on integrated safety, it is necessary to find a methodology to use these HBMs for Pre-Crash phase investigation as well (Iwamato, et al., 2013) (Pruggler, et al., 2011). Previous work has shown that existing THUMS-D without the active muscles is too stiff for Pre-Crash Phase (Shelat & Blaschke, 2014). This was evident from the results, when used under 1g loading condition, that THUMS-D (with and without active muscles) response is well within the corridors (Shelat & Blaschke, 2014) of the volunteer data reported by (Pruggler, et al., 2011). However, higher excursions were expected for THUMS-D without the active muscles. Therefore, there is a need to relax existing THUMS-D model and validate it against appropriate test data. One option for validation is, to use PMHS testing data available in research community, which represents human behaviour without any muscle tonus. There are limited PHMS data available for 1g loading conditions & for the present work the PMHS data produced by (White, et al., 2009) is used.

In this work few parameters are identified and investigated for relaxing THUMS-D. Skin stiffness, as well as, spine ligament stiffness, material model, and mesh are few of these parameters. Modifications are made in existing THUMS-D based on the identified parameters and then validated for PMHS response. These modifications are done on the entire HBM to meet the requirements. Primary results show that, for this particular load case, head rotation is more significant than neck and pelvic rotation. The thickness of the flesh elements and the elements connecting neck skin to head skin also has significant influence on the Head-Neck rotation.

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