Human modeling and Q6 kinematics

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Ifsttar
6 Y.O. Human model

• Geometry: child CT scans + non linear geometrical scaling to match GEBOD anthropometry (a)
• Extremities, head neck simplified (Articulated RB, torso deformable).
• Validation (based on child PMHS data unless otherwise noted): reasonable response for
  – Thorax: diagonal belt\(^1\), hub impact\(^2\), distributed belt\(^1\)
  – Abdomen: lap belt loading lower abdo\(^1\), lap belt loading upper abdo\(^1\), lap belt loading (porcine scaled)\(^3\)
  – Lumbar region: torso flexion test (HIII 6YO setup, (b))\(^4\)
  – Kinematics: low level deceleration (child volunteers, (c))\(^5\), sled pulse with harness\(^6\)
  – To do (looking for additional info for these setups): sled pulse with shield\(^7\) and abdomen hub impact, attempt to scale adult data on submarining?
  – Covers most datasets available child datasets
• MODEL STILL EVOLVING
  – Work on stability, relative stiffness of spine regions, adding Kallieris, etc

Sled testing

• Bench model provided by TUB (developed during CASPER) + some minor modifications

• Positioning:
  – Standard: within the same space as the dummy belts used by TUB
  – On simplified booster (provided by TUB)
First results with the human model

• Model submarines (and abdomen is loaded) on standard bench without CRS
  – And also on flattened bench
• Model does not submarine (abdomen is not loaded) when CRS is used
  – And also when no CRS is used but spine is rigid, or foam stiffness is 10x higher
• Belt slippage on thorax seems less than on the dummy
Perspectives

• Results are different from dummy tests
• Continue work on human model to increase confidence
  – Scaled adult tests (e.g. Luet et al., 2012), Kallieris tests
• Look for improved positioning procedure
• Continue collaboration with TUB to look for parameters that could affect dummy response