

Developments in Finite Element Safety Models

J. Rasico

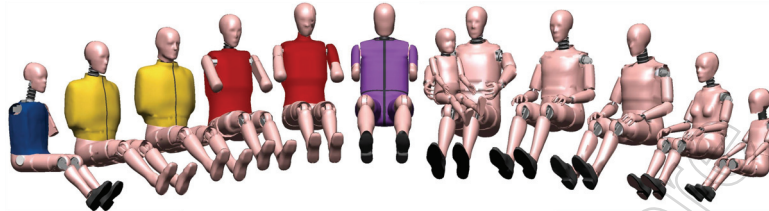
FTSS

Summary:

FTSS has been providing Finite Element models to the safety community for over a decade. This has resulted in an expansive family of; commonly used Anthropomorphic Test Devices (ATDs), dummies primed for future regulation, and complimentary safety tools for the examination of unique protection systems, such as ejection mitigation.

In conjunction, the last 10 years have seen a continuous demand for increased quality and functionality of existing dummy model products, and new tools to help safety engineers address the evolving requirements of regulatory bodies and consumer agencies. While an expanding database for development and validation has helped dummy models reach further levels of maturity and accuracy, close involvement with physical product design and development has allowed for early adaptation of hardware updates. Furthermore, collaborative efforts within the automotive community have become a key component of new model development. With this approach, these new models target the upfront requirements of OEMs and their suppliers.

Further improvement of existing models and end-user participation for the development of new models is leading to more powerful ready-to-use models for safety engineers in the Finite Element community.



Developments in Finite Element Safety Models

Slide no. 1



Contents

- **Modular Models**
- **SID-IIs** (contents in presentation only)
- **H305**
- **H350** (contents in presentation only)
- **FLEX-PLI-GTR**

Slide no. 2



Modular Models

- *H305 now available*
- *H350 – New Module*

Slide no. 3

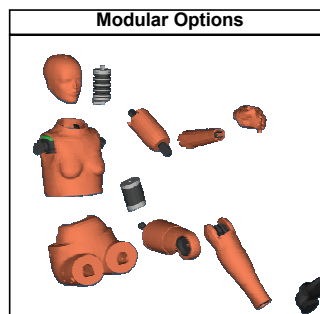


H3-5th Modular Model

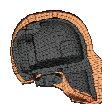
Specification

- Modular functionality (*INCLUDE files)
 - Users choose either deformable or rigid module
 - Maintains existing geometry
 - Positioning file and data extraction capabilities preserved
- Very efficient Spring + Rigid Body neck and lumbar spine models with realistic performance
- Minimum time step controlled by deformable components

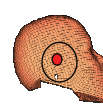
Modular Options



Deformable



Rigid with assigned
C.O.G and Mass Inertia



Slide no. 4

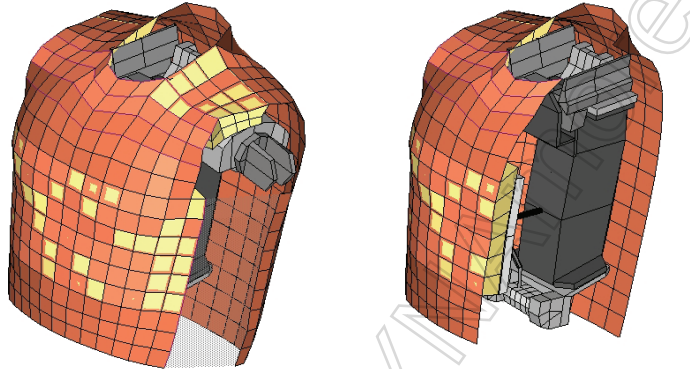
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Modular H3-50th Model: Thorax

Express Chest Module allowing for computationally fast, predictive results

- Simplified Structure (Coarse Mesh)
- Simplified Material Properties
- Representative Joints, Mass and Inertial Properties

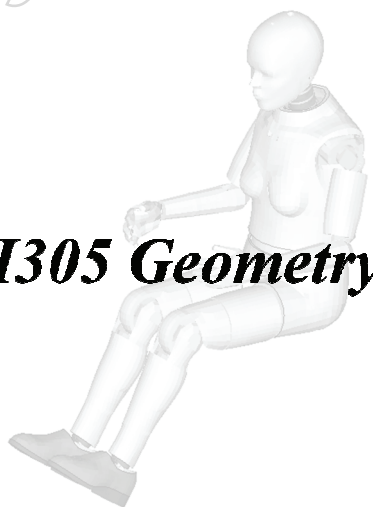


Slide no. 5

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H305 Geometry



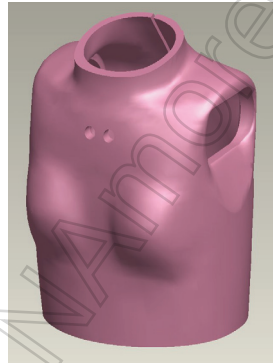
Slide no. 6



H305 Jacket

Harmonized H3 5th Female Jacket

- **Late 1990s:** Independent designs from manufacturers
- **2005:** SAE Paper discusses differences
- **2007:** Harmonized mold developed
- **2009:** Round Robin Testing



Slide no. 7

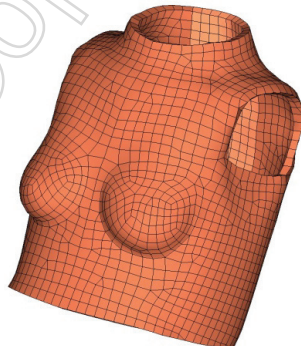
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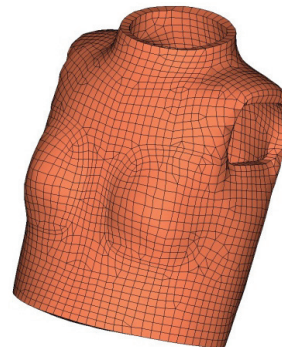
H305 Jacket

Updated versions of the Old and New Design will be made available to FTSS customers

Old Jacket



New Jacket



Slide no. 8

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FLEX-PLI-GTR

Slide no. 9



FLEX-PLI-GTR

Flexible Pedestrian Legform Impactor

- Intended use Global Technical Regulation/Pedestrian Safety leg form test
- Developed by JAMA/JARI

Characteristics

- Flexible femur and tibia bones
 - Human like bending properties
 - Fiber reinforced polymer bones
- Representation of human ligaments
 - Medial, Lateral and Cruciate
- Injury prediction
 - Ligament elongation (4 channels)
 - Bone Bending moment (7 channels)
- Tibia acceleration



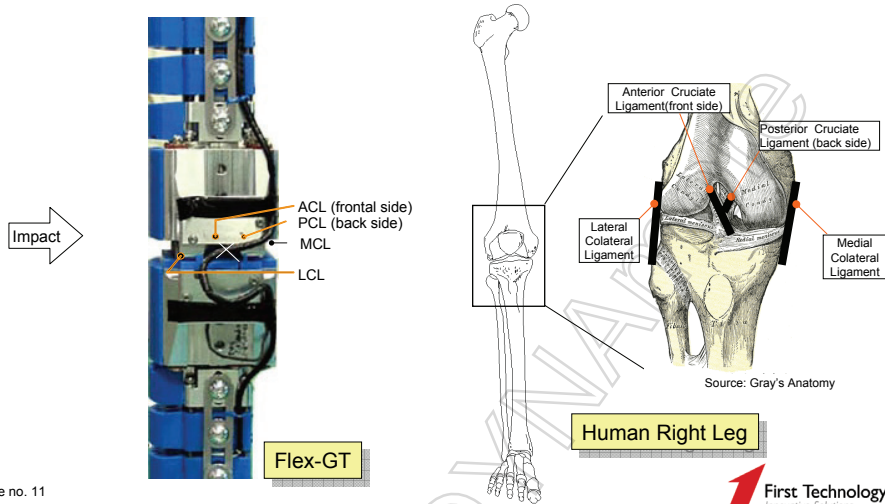
Slide no. 10



FLEX-PLI-GTR

Knee Ligament Arrangements

2 Oct. 2007
JARI



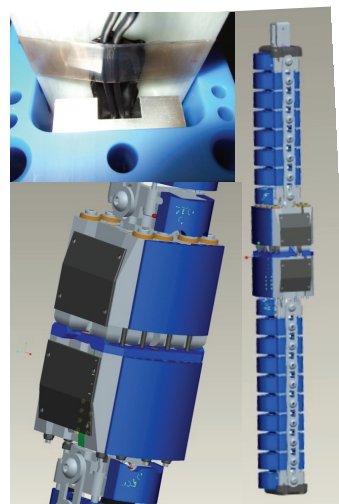
Slide no. 11

First Technology
Innovative Solutions

FLEX-PLI-GTR

Description

- Represents a 50percentile male right leg for lateral impact
- Aluminium and Nylon Segments
- Flexible glass fiber reinforced polymer femur and tibia bones
- Instrumented with strain gauges
- Spring loaded steel cables to represent collateral and cruciate ligaments
- Allows up to 30° bending at knee
- Allows shear at knee
- Launching support bracket at tibia
- Rubber and neoprene sheets to represent skin and flesh

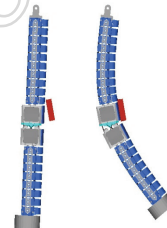
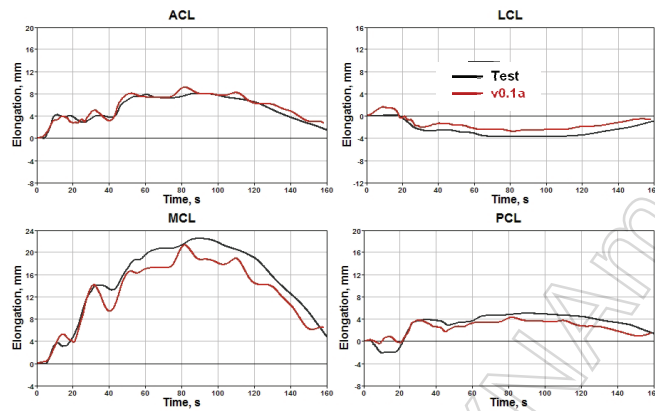


Slide no. 12

First Technology
Innovative Solutions

FLEX-PLI-GTR

Pre-Alpha Model: Pendulum Impact (Generic Materials Only)

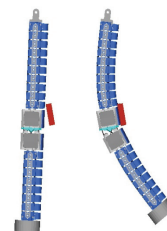
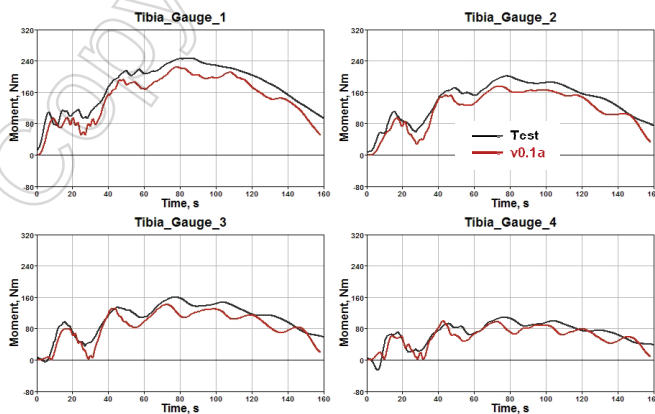


Slide no. 13

First Technology
Innovative Solutions

FLEX-PLI-GTR

Pre-Alpha Model: Pendulum Impact (Generic Materials Only)



Slide no. 14

First Technology
Innovative Solutions

