HBM Variants Generation based on the occupant's BMI

BETA CAE Systems S.A

HBM Variants Generation Tool

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Outline

- Problem Statement
- Proposed Solution
- Key Features
- Main Advantages
- Wide Range of BMIs
- Profound Mesh Quality
- Outputs & Compatibility with Analysis Tools
- Case Study

Problem Statement

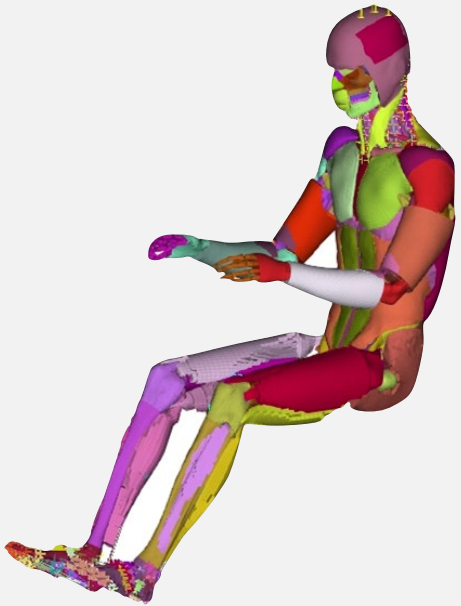
- State of the art models represent only a small sample of the population.

Problem Statement

- Occupant injury patterns and kinematics are linked to the subject's BMI.*

- Current variant generation processes:
  - Are solely based on morphing techniques

    ->Mesh of poor quality.
  - Do not take into account the variation of abdominal organs' volume vs subject's BMI.



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*Hamed J. , Vivek M. , Restraint Optimization for Obese Occupants, Government Industry Meeting, 2019, Washington DC, USA

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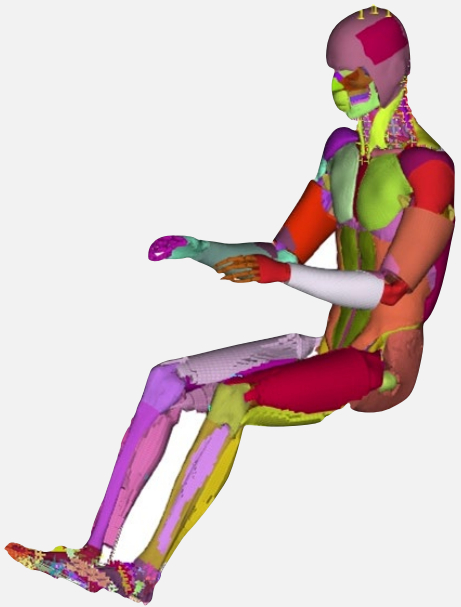
ANSA HBM Variant Generation Tool

- Combination of Meshing and Morphing Tools
- Automatic generation of HBM Variants in 25 mins

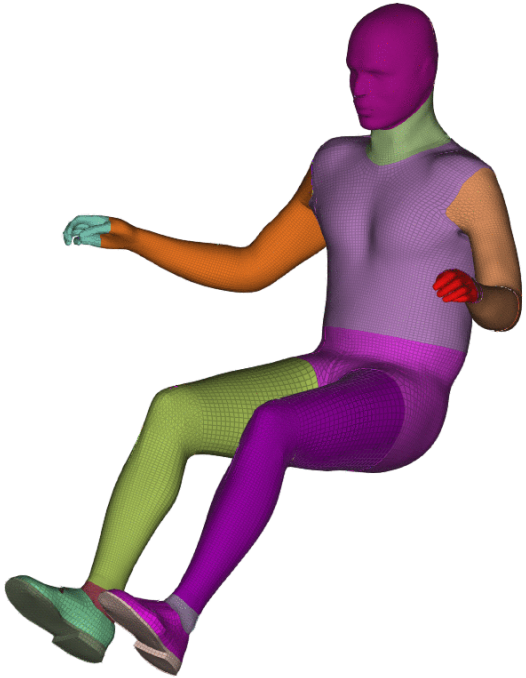
  -> BMI as sole input.

Key Features

- Wide range of BMIs (26 to 40)
- Enhanced creation of subcutaneous fat.
- Abdominal organs morphing.

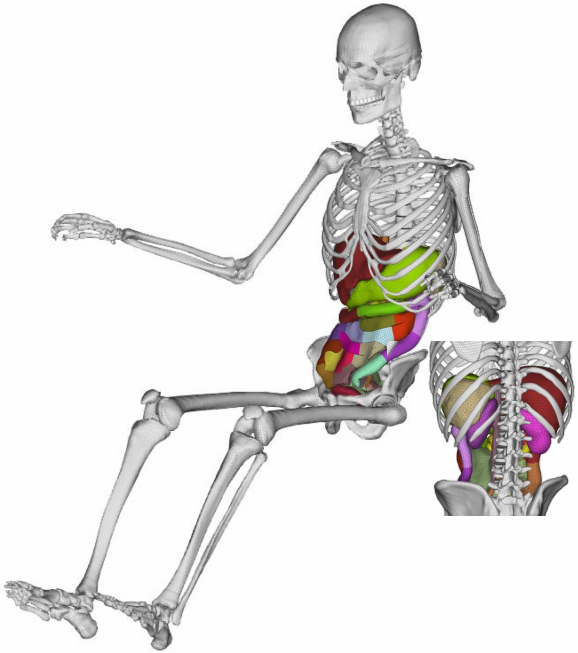


ANSA HBM Variant Generation Tool
Key Features – Enhanced Creation of Subcutaneous Fat



BETA Bio

ANSA HBM Variant Generation Tool
Key Features – Abdominal Organs Morphing



- Liver
- Pancreas
- Gallbladder
- Kidneys
- Stomach

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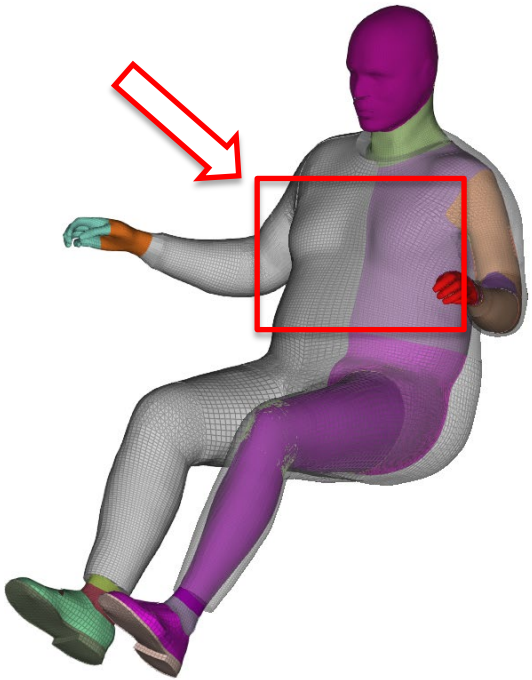
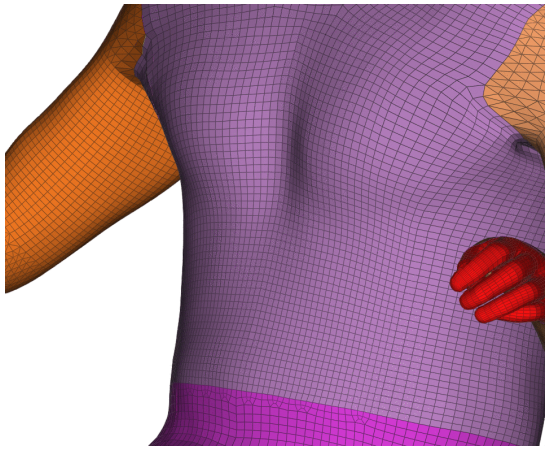
- Developed for GHBMC model but can be extended to any HBM.
- Requires the simple addition of an ANSA metadata file.
- Creation of a new variant within 25 mins.
  - No prior knowledge of morphing or meshing is required.
  - Profound meshing quality.

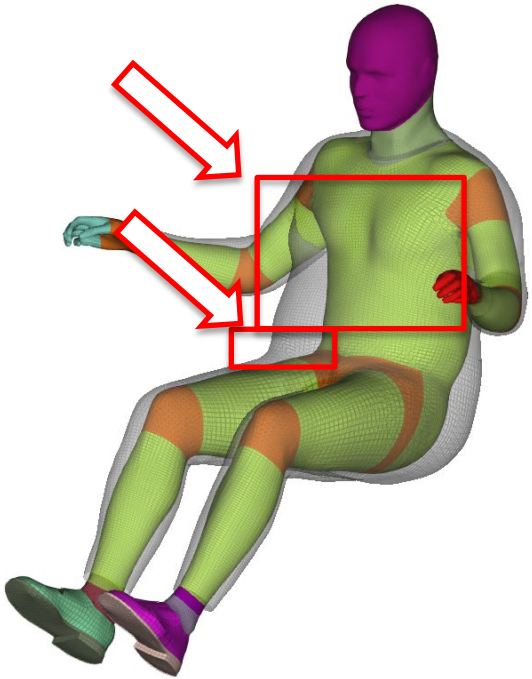
ANSA HBM Variant Generation Tool
Main Advantages – Profound Mesh Quality

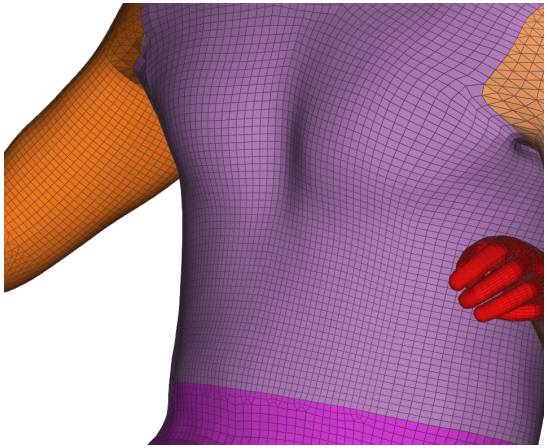


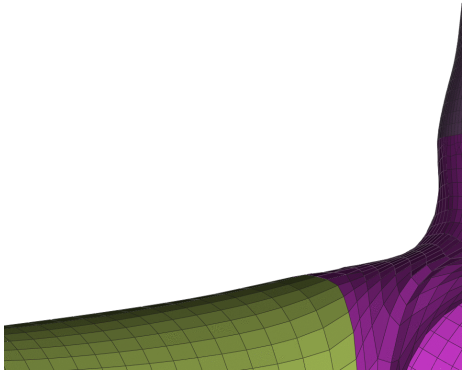


- The number of rows is adjusted to the model's BMI.
- Smooth element density.

ANSA HBM Variant Generation Tool
Main Advantages – Profound Mesh Quality







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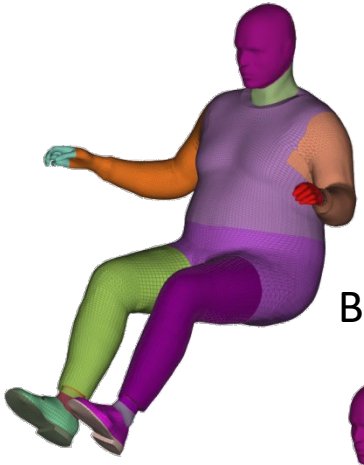
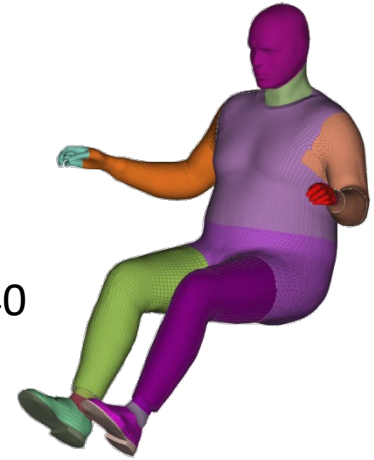
Outputs & Compatibility with Current Analysis Tools



BMI = 40



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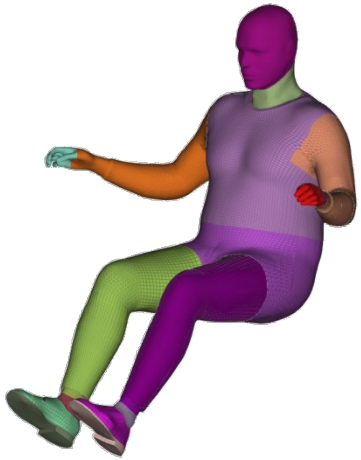

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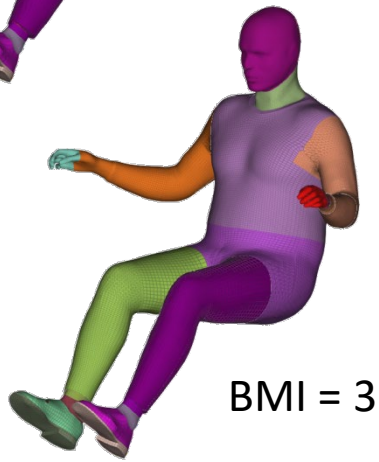

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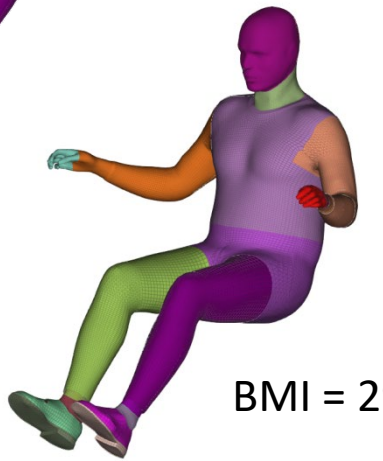

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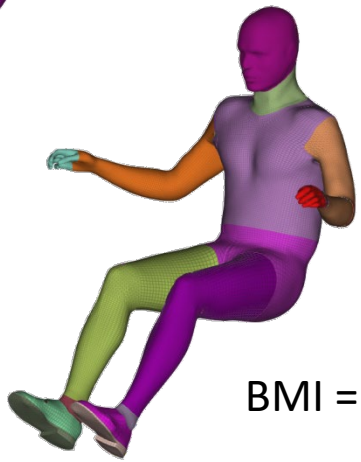
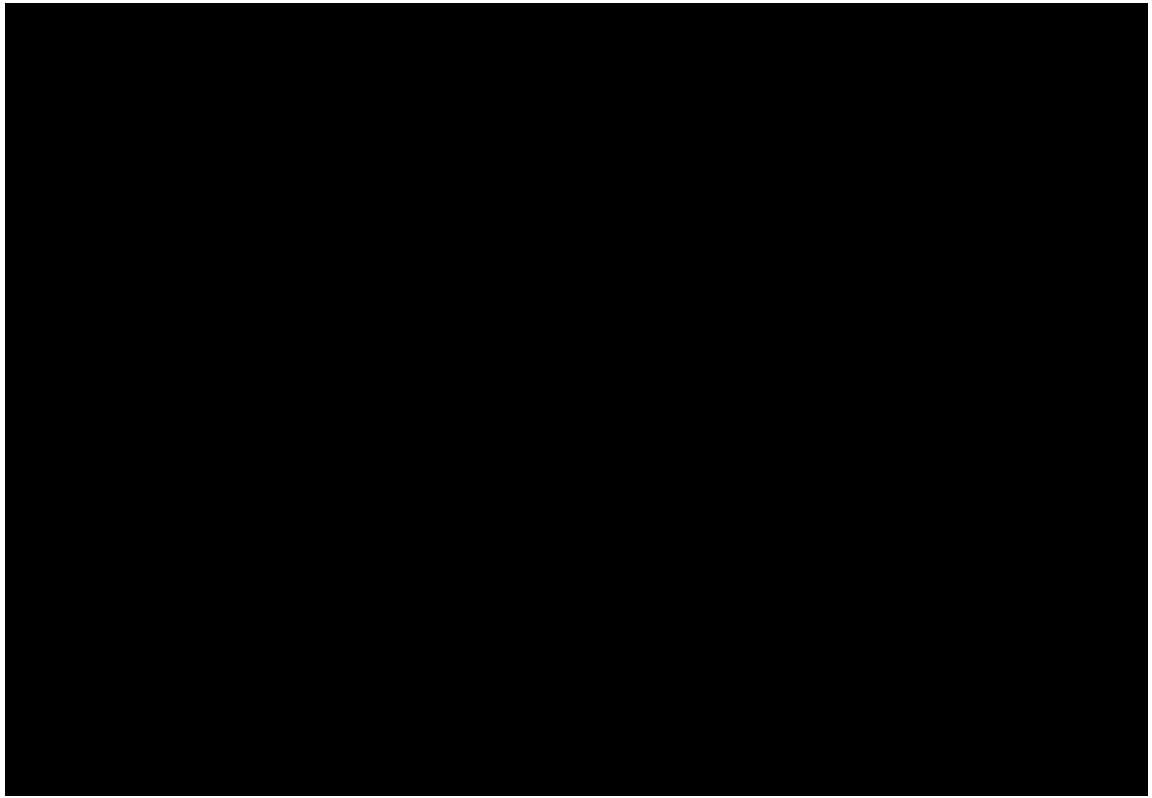


BMI = 26

- All new elements organised in a new *INCLUDE
- Direct output of the *NODE keywords
- Can be coupled with all existing tools
  - Seatbelt Tool
  - HBM Articulation
  - Seat Positioning
  - Mesh Check / Fix Tools

ANSA HBM Variant Generation Tool
Outputs & Compatibility with Current Analysis Tools



- HBM Variants tool
- HBM Articulation tool
- Seatbelt tool

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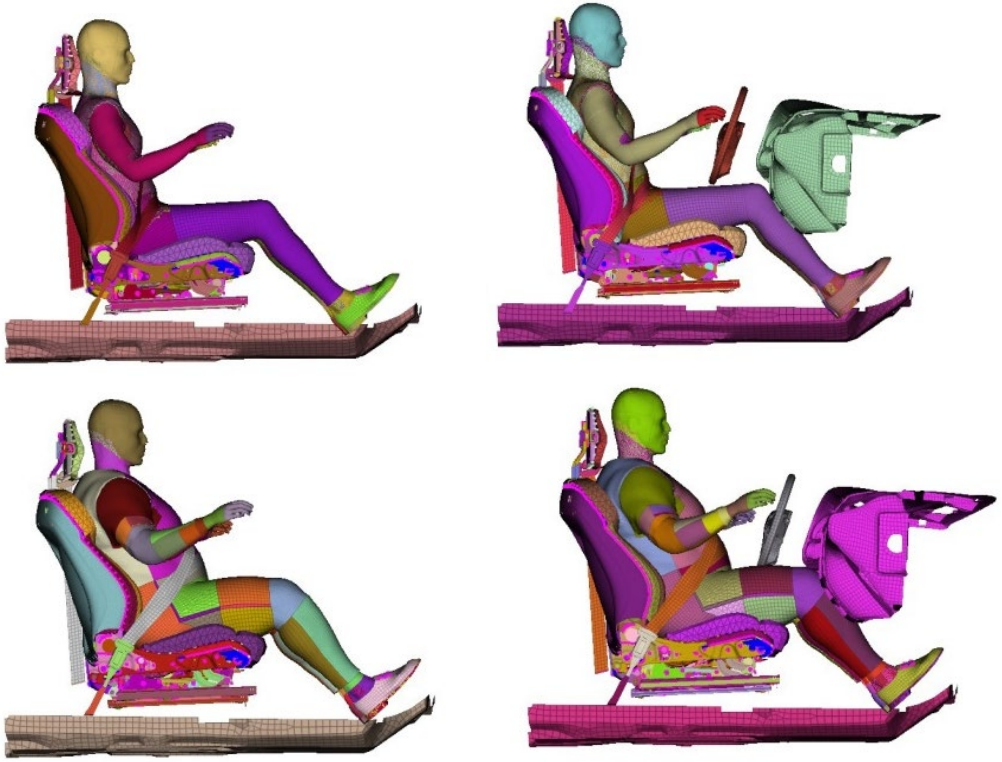
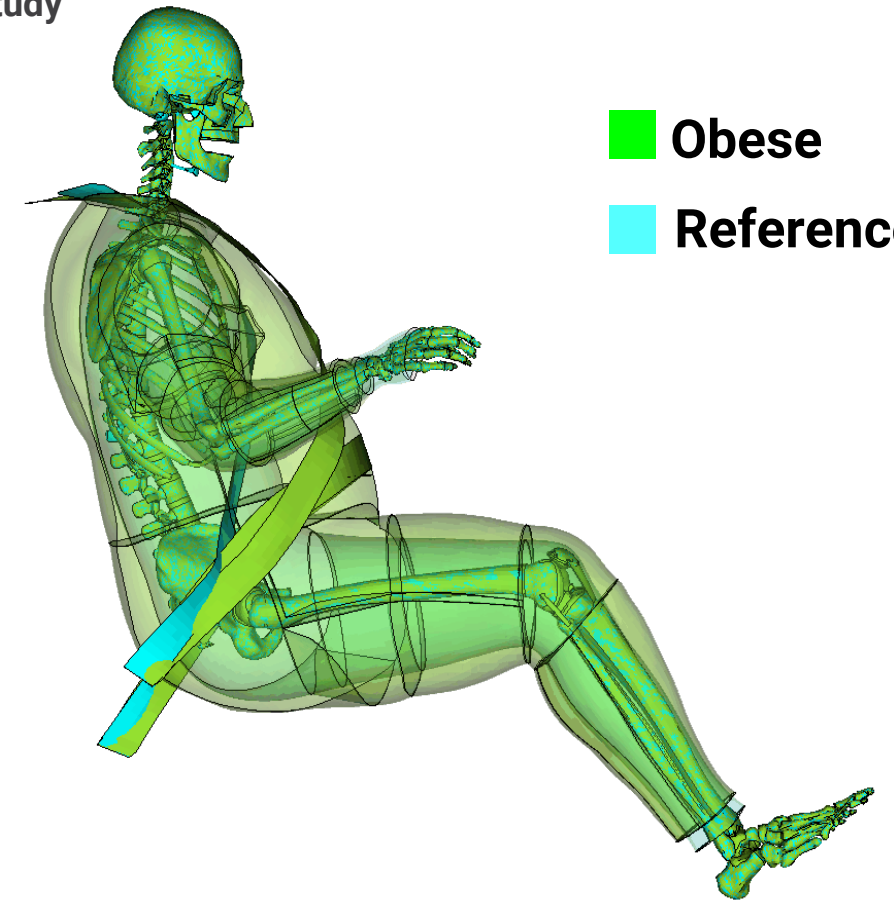
Case Study



- Kinematics w/o IP
- Loadings with IP

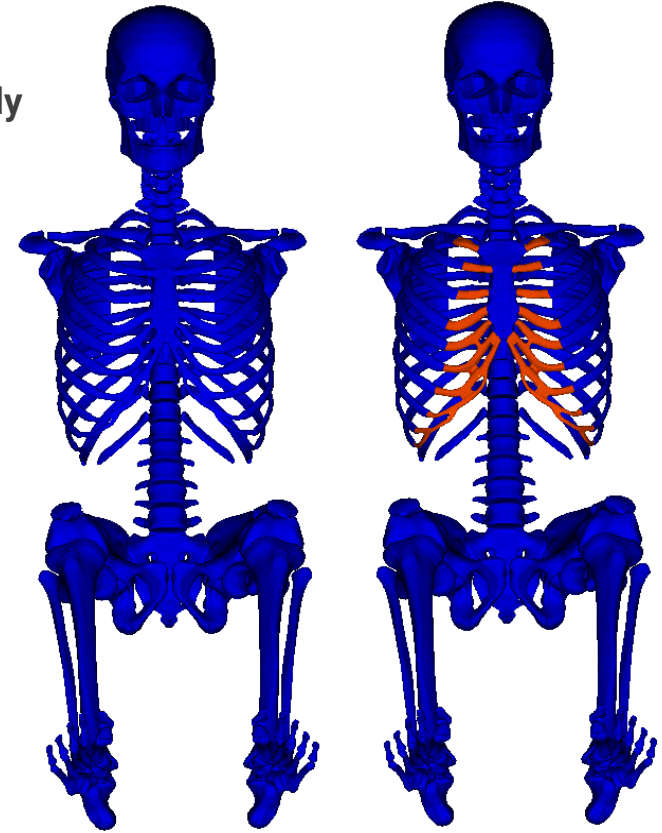
Case Study



Obese

Reference

Case Study



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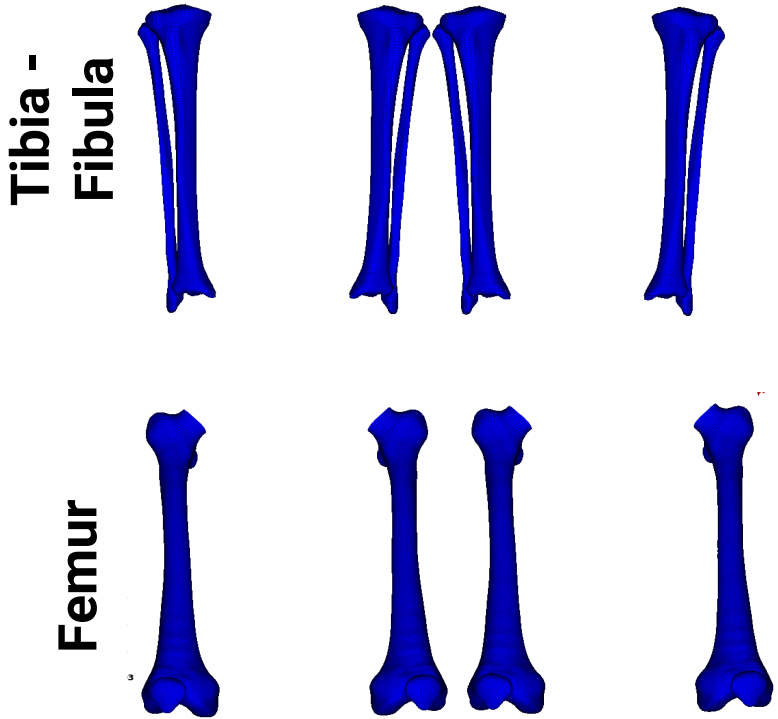

Reference Obese

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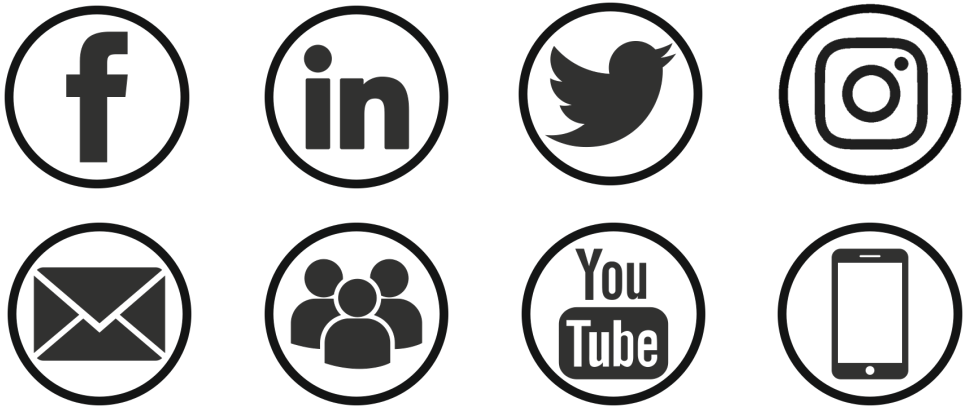
SIMULATION SOLUTIONS



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