

3D Image Visualization, Meshing and Analysis with Simpleware and Abaqus®

Simpleware provides industry-leading software solutions for converting 3D image data (MRI, CT, micro-CT...) into robust computational models. Simpleware software enables direct import of multi-part volume meshes to Abaqus FEA for FE and CFD analysis, removing the need for further processing in other packages.

Key application areas for using Simpleware and Abaqus together include:

INDUSTRIAL REVERSE ENGINEERING

- » Non-destructive Evaluation (NDE)
- » Fault Inspection
- » Legacy Parts

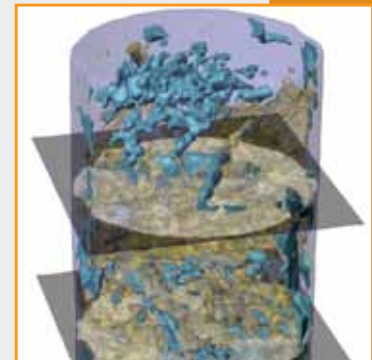
Simpleware's technology opens up new opportunities for the analysis of industrial components, allowing for the inspection and measurement of defects, and for the reverse engineering of legacy parts. Volume meshes can be generated for further analysis and characterization of material properties and microstructures in Abaqus.



MATERIALS & GEOLOGY

- » Rock Physics
- » Composite & Material Analysis
- » Pore Scale Fluid Flow

Simpleware software is capable of rapidly visualizing, processing and meshing samples from imaging modalities such as micro-CT and FIB-SEM. Identify pore networks and cracks, obtain statistics and measurements for pore volumes, surface areas and fiber orientations, and export multi-phase meshes for further testing in Abaqus.



MEDICAL & DENTAL

- » Biomechanics & Orthopedics
- » Implant Design
- » Physiological Flows & Hemodynamics

Simpleware provides detailed, simulation-ready models for medical and dental research. Visualize, segment and analyze complex anatomical datasets and integrate with CAD models of implants or stents. Generate robust multi-part meshes and export with contact surfaces, shells, nodes and material properties to Abaqus for analyses of contact mechanics and physiological flows.



User Case Studies

There are many potential ways in which Simpleware and Abaqus can be used together when preparing and analyzing image-based computational models. The two case studies below highlight some particular applications for biomedical and materials research.

FINITE ELEMENT ANALYSIS OF HEAD IMPACT IN CONTACT SPORTS

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Simpleware and Abaqus have been used together to create and analyze a human head model to simulate traumatic brain injuries, and to assess protective headgear performance in contact sports. Image data from an in-vivo MRI scan was imported and segmented into multiple regions of interest using various automated and manual tools. The segmented regions were then meshed to create a multi-domain FE model that could be subjected to different impact conditions using Abaqus/Explicit. The final model has provided a successful basis for fully understanding traumatic brain injuries and the role of protective equipment in preventing them from occurring.



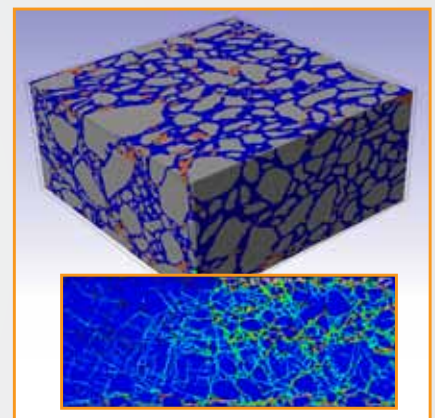
FE mesh of NRL-Simpleware head model with football helmet

FINITE ELEMENT MODEL FOR FULL-SCALE ACCELERATED PAVEMENT TESTING

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Simpleware and Abaqus have been used to test strain displacement distributions in asphalt concrete pavement sections. X-ray computed tomography images of different asphalt mixtures were visualized in Simpleware software and segmented to create regions for mastic, aggregate and air voids. A multi-domain tetrahedral mesh was generated and exported to Abaqus, where heterogeneous viscoelastic material models were applied from laboratory tests. Simulations were run to obtain the shear strains of asphalt mixtures at different temperatures and loading frequencies. The results are being used by researchers to develop a clearer perspective on the important problems involved in the design of asphalt pavements.



FE model of asphalt mixtures and distributions of max. principal strain

About Simpleware

Simpleware develops industry-leading image processing software solutions for 3D image data visualization, analysis and model generation.

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