

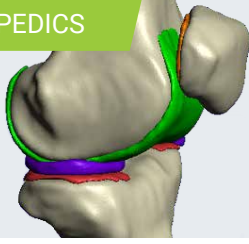
# Simpleware Software Solutions for Life Sciences

From 3D Images to Models



# Applications in Life Sciences

## ORTHOPEDICS



### Accurate Anatomical Models

- Automated and semi-automated tools to segment anatomies
- Combine CAD implants and anatomical data
- Accurately quantify bone geometries
- Export multi-part FE/CFD meshes to solvers

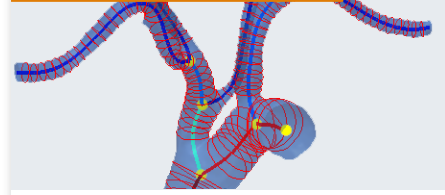
## PRODUCT DESIGN & ANALYSIS



### Consumer Products & Wearables

- Customize product designs to individual anatomies
- Virtually check the fit and function for devices including electronic wearables
- Export models to simulate real-world performance
- Gain better insight for future products by analyzing real anatomies

## CARDIO & RESPIRATORY



### Physiological Flow Analysis

- Reslice images along vessels and airways
- Combine anatomical data with stent models
- Mesh boundary layers and add custom inlets and outlets for fluid flow analysis
- Quantify vessels with centerline network tools

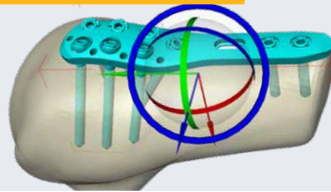
## EM & NEUROMODULATION



### Human Body Models for Simulation

- Use automated and/or semi-automated segmentation tools
- Integrate CAD designs like MRI coils or electrodes with image data
- Easy-to-use registration tools for positioning devices
- Generate and export simulation-ready meshes

## MEDICAL DEVICE R&D



### Device & Image Integration

- Rapidly integrate CAD devices into CT/MRI scans
- Research human/device interactions
- Automate repeatable operations with scripting
- Simulation-ready meshes suitable for analyzing device performance

## 3D PRINTING MODELS



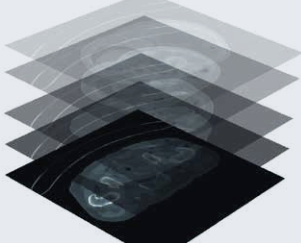
### Development & Investigation

- Print accurate anatomical models and integrate implants or devices
- Prepare models using the dedicated 3D printing toolkit
- Use analysis and inspection tools to get the perfect print first time
- Use 3D printed models for R&D, teaching and training



# From Image Processing to Model Generation

## Image Processing



### Import & Registration

#### Modalities

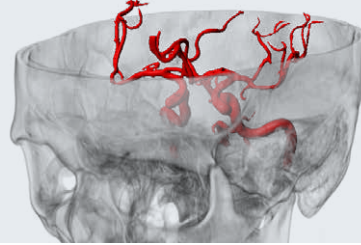
- MRI
- CT
- Micro-CT
- Ultrasound
- Confocal microscopy
- 2D X-ray images

#### Formats

- 3D & 4D DICOM
- 2D image stacks (BMP, JPEG, TIFF...)
- Raw image data (RAW, VOL...)

#### Options

- Co-registration of multiple 2D and/or 3D datasets
- Store and manage DICOM tags
- Anonymization
- Compatible with PACS



### Visualization

#### Volume Rendering

- GPU rendered
- Combine with surface/mask/mesh renderings

#### Object Visualization

- 3D live mode for instant updates
- Range of 2D and 3D visualization options
- Overlay surface contours in 2D
- Interactive image reslicing with multiplanar reconstruction mode

#### Animations

- Rotate, clip and fly-through
- 4D cine modes

#### Exports

- Generate and share 3D PDFs
- Generate virtual X-rays
- DICOM, screenshots & videos



### Image Processing

#### Image & Mask Filters

- Noise reduction
- Smoothing/morphological filters
- Align, rescale and resample
- Robust Boolean operations

#### Segmentation

- Threshold, floodfill and painting
- Interactive 3D editing tools
- Advanced region-growing tool
- Contour-based magnetic lasso
- Tools for handling poor contrast, artefacts and low quality data
- 3D wrap tool for scaffold-based segmentation
- Split tool to separate parts automatically
- Greyscale-based slide-to-slice propagation and interpolation
- Local surface correction to compensate for artefacts
- De-stepping

## The Simpleware Solution

Synopsys Simpleware™ software provides an industry-leading, comprehensive 3D image processing platform for handling 3D scan data. Accurately process images with a wide range of tools for visualizing data, obtaining image statistics and carrying out segmentation, right through to generating 3D printing and simulation-ready models.

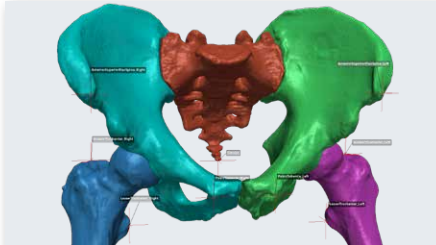
## Improve Life Sciences Workflows

Simpleware software is accessible to both beginners and more advanced users. The intuitive interface provides quick-and-easy access to a range of powerful tools, including fully automated anatomy-specific segmentation. AI/ML tools significantly streamline workflows for analysis and medical device design, making it straightforward to save time without compromising on accuracy.

# From Image Processing to Model Generation

## Auto Segmentation

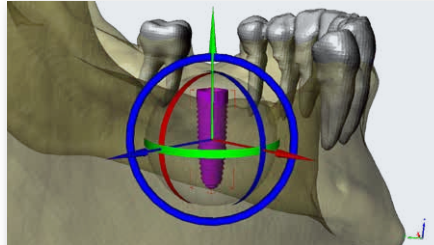
## Surface Tools



### AI Segmentation & Landmarking\*

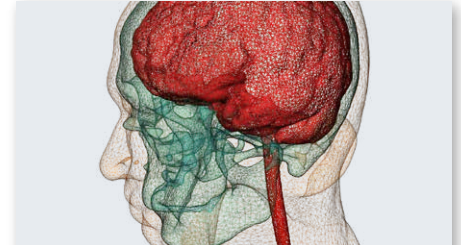
- Ankle CT segmentation and landmarking
- CMF CT segmentation and landmarking
- Heart CT segmentation and landmarking
- Heart Valve analysis
- Hip CT segmentation and landmarking
- Hip Revision CT segmentation and landmarking
- Knee CT segmentation and landmarking
- Knee MRI segmentation and landmarking (including cartilage)
- Shoulder CT segmentation and landmarking
- Spine CT segmentation

All tools use fully automated AI-based machine learning



### Working with Image & CAD Data

- Import CAD files (STL, STEP, IGES)
- Automatic fixing of erroneous CAD data on import
- Automatic snap or landmark-based registration
- Surface deviation analysis for comparing objects
- Robust Boolean operations
- Surface filters to smooth, decimate, resurface, fill holes
- Surface editing tools to group/ungroup, extrude, hollow, clip
- Sweep pipes/tubes along centerlines
- Preserve CAD edges when combined with image data
- Import and interactively position SOLIDWORKS® parts or assemblies with 3D image data\*\*
- Automatically update design changes made in SOLIDWORKS\*\*



### Surface Model/Mesh Generation

- Create robust surface models using a choice of algorithms
- Volume and topology preserving smoothing
- High-quality triangulation (no need for fixing or post processing)
- Guaranteed watertight and conforming multi-part surfaces
- Full user control over global and local mesh coarseness / refinement

#### Inspect and Export Surface Models

- Inspect model quality for errors and warnings
- Pin-point inspection locations within the image/segmentation
- Export surface meshes (STL, OBJ, 3MF...)
- Export NURBS surfaces (STEP & IGES)

## Have Confidence in Your Product Designs

Simpleware software is ideal for rapidly testing out different design iterations involving consumer products and the human body. Achieve reliable results every time with straightforward image processing, measurements, and export of robust STL and NURBS CAD files. Generate guaranteed high-quality FE meshes to evaluate biomechanical performance under real-world conditions.

\*Only available in Simpleware Medical

## Integrate Image and Design Data

Unique capabilities allow you to combine computer-aided design (CAD) models within 3D image data to capture realistic anatomical details whilst accurately maintaining the design features of the CAD data. Avoid the challenge of combining CAD and image data by using Simpleware software, with additional options for synchronizing models with SOLIDWORKS®.

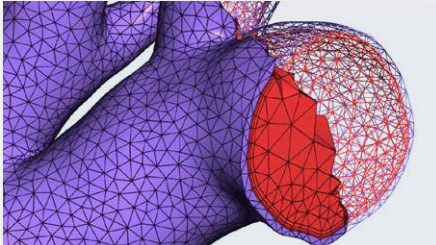
\*\*Not available in the Linux operating system

# From Image Processing to Model Generation

## Volume Mesh Tools

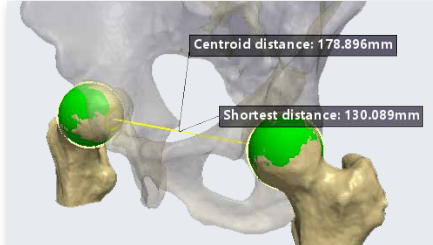
## Measurements

## 3D Printing



### Meshing for FEA & CFD

- Conforming multi-part volume meshes
- Feature-based and user-defined mesh refinement
- Per-part meshing controls
- Define contacts and node sets
- Hounsfield material mapping for FE exports
- Boundary layer meshing
- Dedicated native export for all major solvers
- Optimize element qualities against a choice of metrics
- Import existing meshes and assign material properties
- Segmentation checker to identify and fix problematic regions before meshing
- Mesh quality histogram to inspect generated mesh



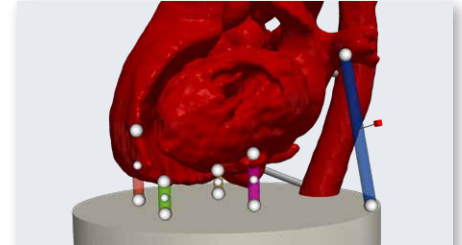
### Measurements & Statistics

#### Interactive Tools

- Simple quick statistics and measurements
- Generate and probe centerlines networks
- 2D & 3D shape fitting and statistics
- Wall thickness analysis

#### Statistics Framework

- Thoroughly interrogate image data, generated models, or centerlines
- Extensive range of metrics
- Highly flexible for creating custom statistics templates
- Generate PDF reports describing your data



### 3D Printing Toolkit

- Prepare models using dedicated tools to cut, hollow, emboss text, create connectors
- Create interlocking 3D parts using pins-and-sockets
- Check models before export
- Export multiple formats designed for 3D printing

#### Cutting Guides Design Tool

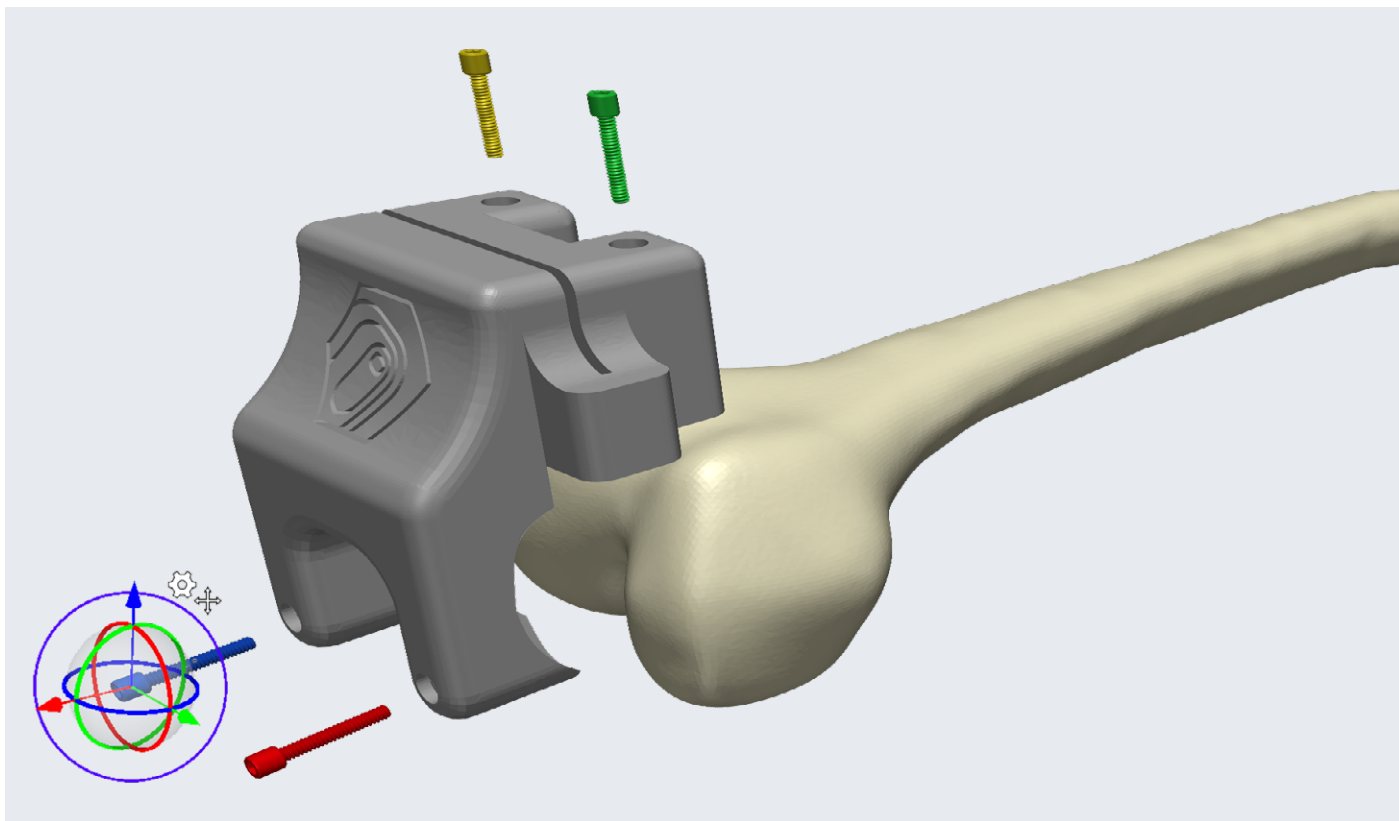
- Efficiently design patient-specific bone cutting guides
- Create cutting track, pin/drill holes and a base
- Revisit and modify designs, and regenerate the model
- Guides fit exactly on the region of the bone to be cut during surgery

## From Image to Mesh

Simpleware software offers a direct route from image data to simulation. Generated meshes are ready to use in the FE/CFD solver of your choice, with extensive options for tailoring your models to different simulation requirements. Rely on software that generates simulation-ready models, with no need for post-processing or fixing. Export directly to all major solver formats.

## Customize your Workflow with Scripting

Simpleware software offers many ways to help save time and effort, such as the 'My tools' tab and scripting. All Simpleware functionality is accessible from a fully documented scripting API, with bindings available for Python and C#. Use this API to automate repeatable workflows, build wizards and integrate custom plugins. Generate code without any prior experience by using the macro recording functionality.



## Custom Model Generation and Services

Our service team can generate models for any application. We will work with you to develop a model, or series of models, that are tailored to your specific needs. This can be based on your own scan data or we can work from our library of high-resolution image datasets. Contact us if you have any questions.

## Training at All Levels

Receive step-by-step training on all areas of Simpleware software. We offer classroom training courses at local Synopsys offices or at your site, as well as customized one-to-one sessions at your place of work, or through web meetings. Our interactive courses include a combination of lectures, demos and hands-on tutorials.

## Expert Support for Your Requirements

All licenses come with full support from our team of experts. Our engineers can help you develop unique workflows, ensuring your use of the software is as efficient as possible, and your final output matches your requirements. Our support is offered via email, phone or web meetings, or we can even visit you on-site. Contact us if you have any questions.

## Try Simpleware Software

Try the software for yourself with a free evaluation version, available on our website. The trial is fully functional and gives you access to the complete Simpleware software suite, a full range of tutorials and technical support.

For more information, go to [www.synopsys.com/simpleware](http://www.synopsys.com/simpleware)

Email: [simpleware@synopsys.com](mailto:simpleware@synopsys.com)

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