Altair | HyperWorks®

FEKO for Healthcare

RF Performance and Safety Prediction

FEKO, Altair's comprehensive electromagnetic simulation software suite, is ideal for the simulation of field interactions of antennas near or inside anatomical loads. Applications vary from magnetic resonance imaging (MRI) coil design and implant telemetry, through to surgical tools such as biopsy needle antennas. Simulations early in the design, where homogenous phantoms are typically sufficient, are solved efficiently with the method of moments (MoM). Later in the design, realistic anatomical loads are simulated efficiently using either the finite difference time domain (FDTD) or the hybrid MoM/FEM solver. The complete FEKO solver offering provides approaches for each design stage, from conceptual investigations through to accurate prediction of the radio frequency (RF) and safety performance of the final system.

Solution Highlights

- Straightforward simulation of antennas near or inside the human body
- Accurate prediction of MRI resonance frequencies and tuning capacitor values
- Fast design of MRI systems with homogenous loads using the MoM transfer function calculations of complex detailed implant lead geometries for MRI compatibility
- RF and safety performance including efficiency, gain, averaged specific absorption rate (SAR) and estimated link budget
- System/device performance studies for patient variation, for example, position, posture, gender, age, height and BMI
- Simultaneous multiport matching with Optenni Lab
- Cross-validation strategies using multiple solvers

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Healthcare Capabilities

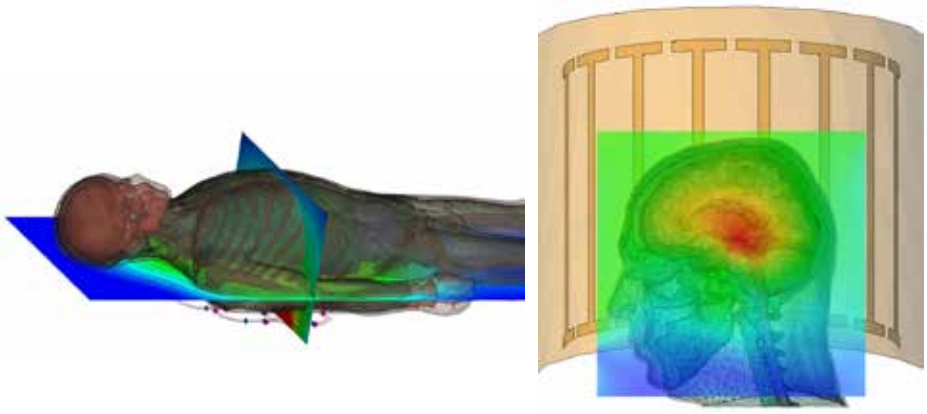
- Triangles are well suited for meshin curved metallic geometries
- Efficient treatment of high Q structures with frequency domain solvers
- Choice of two solvers for anatomical models – the accuracy of the finite element method (FEM)meshes versus the low computational requirements of the FDTD method
- A variety of different anatomical models are available with tetrahedron and voxel meshes
- Standard MRI performance parameters – rotational B_1 fields, averaged SAR
- Lua script implementation of the Pennes bioheat equation for calculating the temperature increase

Interfaces

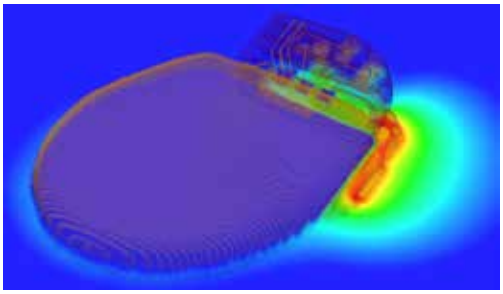
- Most industry standard CAD software and ODB++, 3Di and Gerber layouts
- Mesh importing
- Interface with HyperMesh
- Near field and far field import including general, Orbit/Satimo and Sigirity
- Optenni Lab for antenna matching circuit design
- Touchstone, SPICE circuits and non-radiating networks

General Capabilities

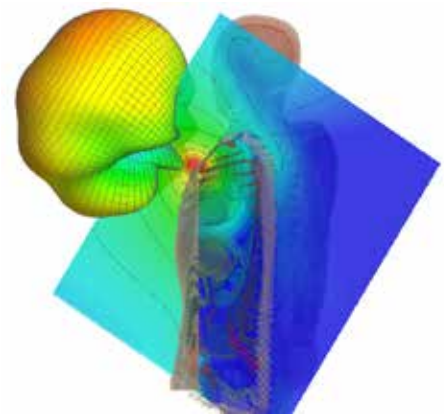
- Comprehensive suite of accurate, powerful, reliable and parallelized solvers with true hybrization, including MoM, MLFMM, FEM, FDTD, PO, LE-PO, RL-GO and UTD
- Complete HPC and GPU features
- 3D parametric environment modeling
- Extensive post-processing capabilities
- Integrated Lua scripting environment for data manipulation and task automation



Accurate MRI coil performance simulation using the hybrid MoM/FEM or FDTD solvers: simulated B_1 field maps for a 3T 7-element spinal array (left) and 7T birdcage head coil (right). The anatomical models were provided by humanbodymodels.com.



The E-field distribution in the vicinity of the antenna of a cardiac pacemaker



Near field and far field radiation patterns for the pacemaker device simulated with an anatomical phantom

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