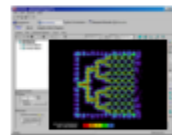
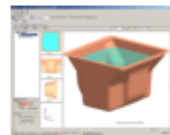
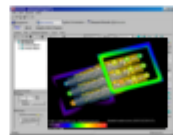
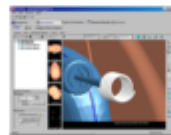
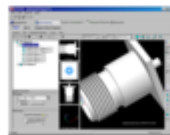


Version 6.2 New Features



This document contains a brief summary of the new features in XFDTD version 6.2. Detailed information may be found in the XFDTD v6.2 User's and Reference manuals.

Automatic Material Assignment

When CAD files are first imported into an electromagnetic solver, such as XFDTD, material assignments that denote the electromagnetic properties of the objects in the CAD file must be made. This is necessary because most CAD programs are designed to create and label geometrical shapes and have limited provisions for assigning other unrelated properties. XFDTD now has provisions to make this initial assignment of material properties easier by allowing materials to be assigned based on color assignments made to the objects in the original CAD file. By choosing the color of objects in the CAD software, users can allow XFDTD to create and assign different materials to each object based on their different electromagnetic characteristics. The user then has only to define the characteristics of each of the materials.

Faster Material Editing

Often, several different materials will be used in an XFDTD computation. XFDTD now includes direct navigation between separate materials as shown in Figure 1. The user may sequence in

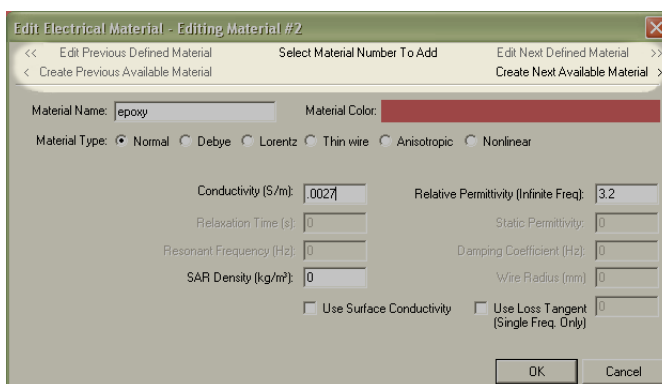


Figure 1: Material Navigation

either direction through the allocated materials and also allocate additional materials without the need to return to the main window. This speeds the process of defining multiple materials by eliminating unnecessary keystrokes.

“Surface” Conductivity

XFDTD can account for the effective conductivity of good conductors at a specific frequency without the necessity of using high cell resolution to resolve the relatively short wavelength within conductors. This is useful for situations where the loss in, reflection from, or propagation around metal surfaces are of interest, but not the detailed structure of the signal inside the metals. Examples of such geometries include metal cavities, conductive parts in and around electronics such as cell phones, and conductive enclosures. Calculations of cavity loss, filter “Q” and of device efficiency benefit from using surface conductivity. A material for which surface conductivity is desired is selected by the “Use Surface Conductivity” check box in the electrical material edit dialog as shown in Figure 2. Figure 3 shows the surface conductivity frequency entry area on the waveform tab. For steady-state problems the selected sinusoidal frequency is used.

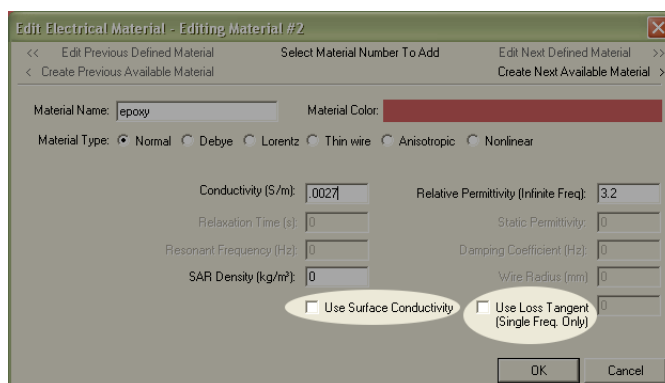


Figure 2: Surface Conductivity and Loss Tangent

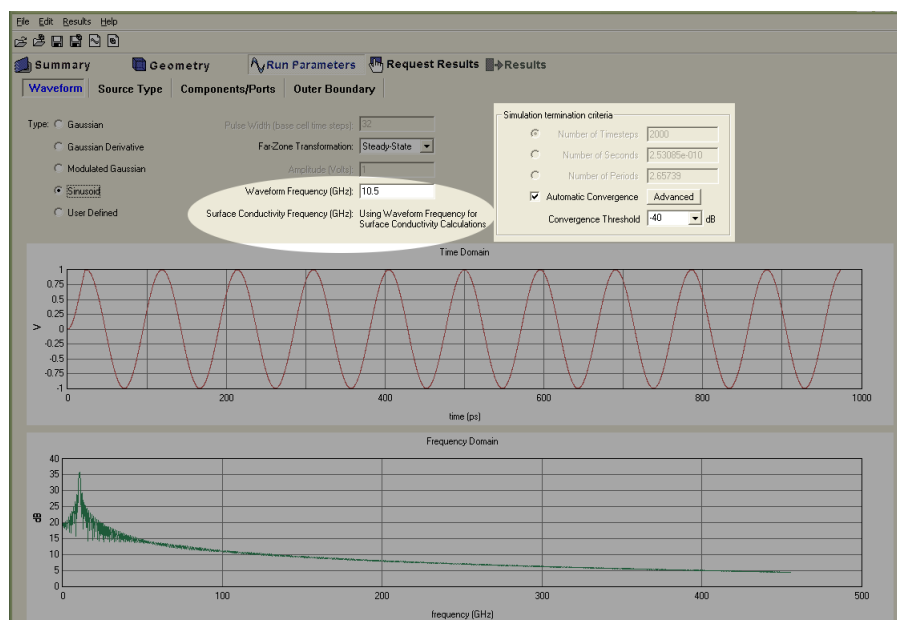


Figure 3: Surface Conductivity Frequency and Convergence Detection

Loss Tangent Material Specification

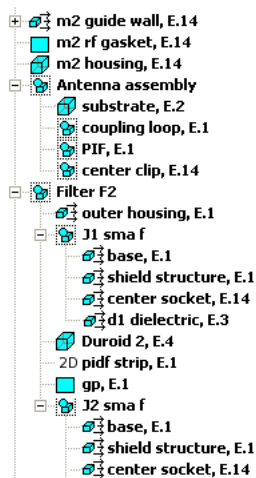
When the loss tangent for a material is known, this value may be used in the electrical material edit dialog as shown in Figure 2. The effective conductivity at the excitation frequency will be automatically computed by XFDTD as $\sigma_{\text{eff}} = \omega_0 \epsilon' \tan \delta$. This is especially useful when the same loss tangent for a material will be used for computations at several steady-state frequencies.

CAD File Name Support

XFDTD now uses the name attribute of CAD files, when available, so that object names assigned from a CAD program are included with the objects when they are imported. Likewise, CAD files exported from XFDTD will include the object names from XFDTD. Examples of CAD file formats which include a name attribute include SAT and STEP.

Object Hierarchy and Material Assignment Persistence

XFDTD supports geometry object grouping, shown in Figure 4.



Unfortunately, neither this information nor electromagnetic material property assignments are included in most CAD files. This means that XFDTD material properties and groupings assigned to objects in a CAD file have to be made again if the CAD file, perhaps updated, is imported into XFDTD again. XFDTD v6.2 allows object grouping, hierarchy, and material assignments to be exported so that when a similar CAD file is imported this information may be applied and objects whose names match those on the exported file will have their group, hierarchy, and material assignments reapplied. This is very efficient when a CAD file to which object grouping, hierarchy, and material assignments have been made in XFDTD is revised frequently, external to XFDTD. When the new file is imported, the old assignments can be made to all matching part names automatically so that assignments need be entered only for new portions of the CAD file.

Figure 4: Portion of XFDTD Geometry List

Drag and Drop Geometry List

Complicated geometries may have hundreds or thousands of objects. In XFDTD v6.2 the geometry list may be quickly organized into groups by familiar drag and drop operations.

Female Body Mesh Supported

The Female Body Mesh is derived from the Visible Human project female body by the NMR group at Hershey Medical Center, Hershey, PA, USA. This mesh is 5 mm resolution and includes 30 unique tissues. It is compatible with both the frequency-dependant tissue calculator and the wide-band dispersive biological tissue features of XFDTD.

Meshing Improvements

XFDTD is already an industry leader in the ability to quickly and reliably turn complicated geometries into accurate electromagnetic meshes. This ability has been extended in XFDTD v6.2 with the addition of an advanced meshing algorithm which makes meshing of certain difficult geometry features possible.

Adaptive Mesh Refinements

Refinements to Remcom's adaptive mesh in XFDTD v6.2 ensure greater overall mesh consistency and accuracy when adaptive mesh regions are present.

Adaptive Mesh for Mesh-Only Objects

Most geometrical objects created from within XFDTD by the geometry editing tools or imported from external CAD files have a solid (or 1D or 2D) representation, and can be turned into a mesh from within XFDTD. Mesh objects, on the other hand, are a defined block of mesh edges that have no CAD-space representation within XFDTD. The most common type of mesh object is a Remcom biological mesh, such as the Remcom high resolution male or female mesh or repositioned male mesh from Varipose. In XFDTD v6.2, adaptive mesh regions may be used in portions of the space that contain mesh objects which will automatically be re-meshed as necessary.

Lofting

A solid object may be formed by "lofting" between two surfaces. The surfaces may be simple surfaces or surfaces of other solid objects. In Figure 5 the surfaces shown in red have been selected for lofting. Figure 6 shows the object created by the loft operation. Full independent control of the "smoothness" at each face is provided.

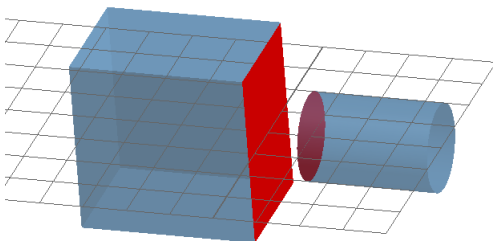


Figure 5: Two Surfaces Selected for Lofting

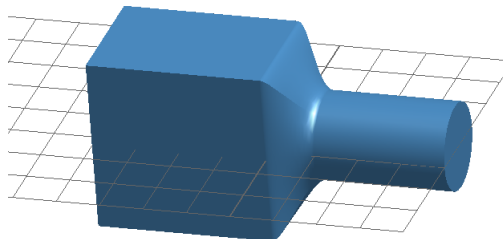


Figure 6: Result of Loft Operation

Scripted 2D Geometries

The "run script" command in the 2D geometry editor dialog will allow for text files with 2D geometry description to be read into the editor and instantiated just as if the geometry had been entered in the 2D editor via the mouse or command area. This gives the user greater flexibility as it is sometimes convenient to describe or modify complicated 2D shapes externally.

Rotate Geometry Object Normal to Face

In XFDTD v6.0 and later, objects in the geometry may be repositioned by rotating them relative to a principle axis. The latest release adds the ability to rotate an object about a vector normal to a selected face of an object. This is useful when a face does not lie parallel to a principle plane. Combined with XFDTD's ability to reposition objects both by entered vectors and by mouse interaction, this represents a significant level of control over the placement of the geometry.

Inventor and Binary STL Import

Inventor and binary STL file formats have been added to the many existing supported file formats available for importation into XFDTD

Automatic Convergence Detection

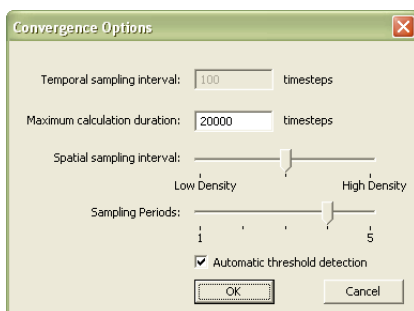


Figure 7: Advanced Convergence Settings

Automatic convergence detection is an optional way to specify the calculation termination criterion. This feature causes the calculation engine to periodically check the signal in the problem space and automatically ends the computation when the transient portion of the signal has decayed to a level specified by the user. When using convergence detection, no prior knowledge of the number of iterations needed for convergence is required. Figure 3 shows the convergence detection area of the waveform tab. In most cases, the default settings are sufficient. Figure 7 shows the optional advanced control available to the user to refine convergence detection, if desired. When automatic convergence detection is not used, a fixed number of time steps may be specified as the stopping criterion, as in earlier versions of XFDTD, or the stopping criterion may be specified in seconds, or, for sinusoidal waveforms, in periods.

System Efficiency

To accommodate the most popular definitions of efficiency and measures of overall power, steady-state results have been updated to include measures of available power (P_A), net input power (P_i), dissipated power (P_D), and radiated power (P_R), as well as radiation efficiency and system efficiency. These definitions are in accord with IEEE Standard 145-1993. In particular, mismatch loss is a common mechanism which can significantly effect efficiency. The measures of power may be scaled so that one measure can be set to a desired value and the others will be scaled appropriately.

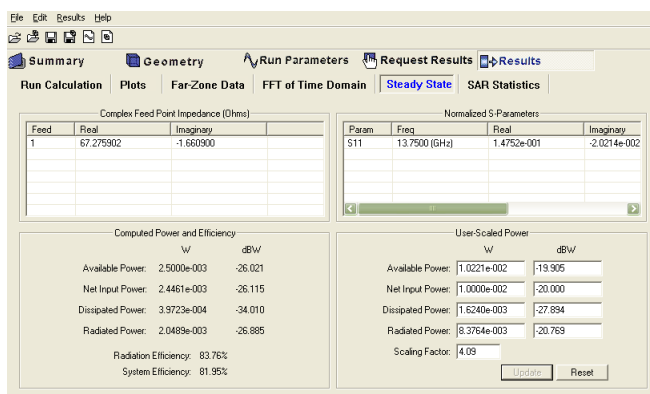


Figure 8: Steady-State Results Including System Efficiency

SAR Computations for MPI

Averaging of raw SAR data can be the most time consuming portion of the computation. In XFDTD v6.1 the single- and multi-CPU shared memory SAR averaging was streamlined yielding approximately a 5x speedup over prior versions of XFDTD in tests with the Specific Anthropomorphic Mannequin (SAM) head model. In XFDTD v6.2 SAR averaging is now fully parallelized for MPI to bring Remcom's leadership in fast, accurate, standards-compliant SAR statistics to cluster environments.

Partial Volume SAR Computations

In some situations, SAR statistics are of interest in only a portion of the computation that does not include all locations in which raw SAR data is available. For example, the problem space may consist of a head and a cell phone, but detailed SAR averages and maximum may be needed only in the region of most intense power absorption around the ear that is near the cell phone. In XFDTD v6.2 SAR averaging may be limited to sub regions of the problem space, which can lead to a significant decrease in SAR averaging computation time.