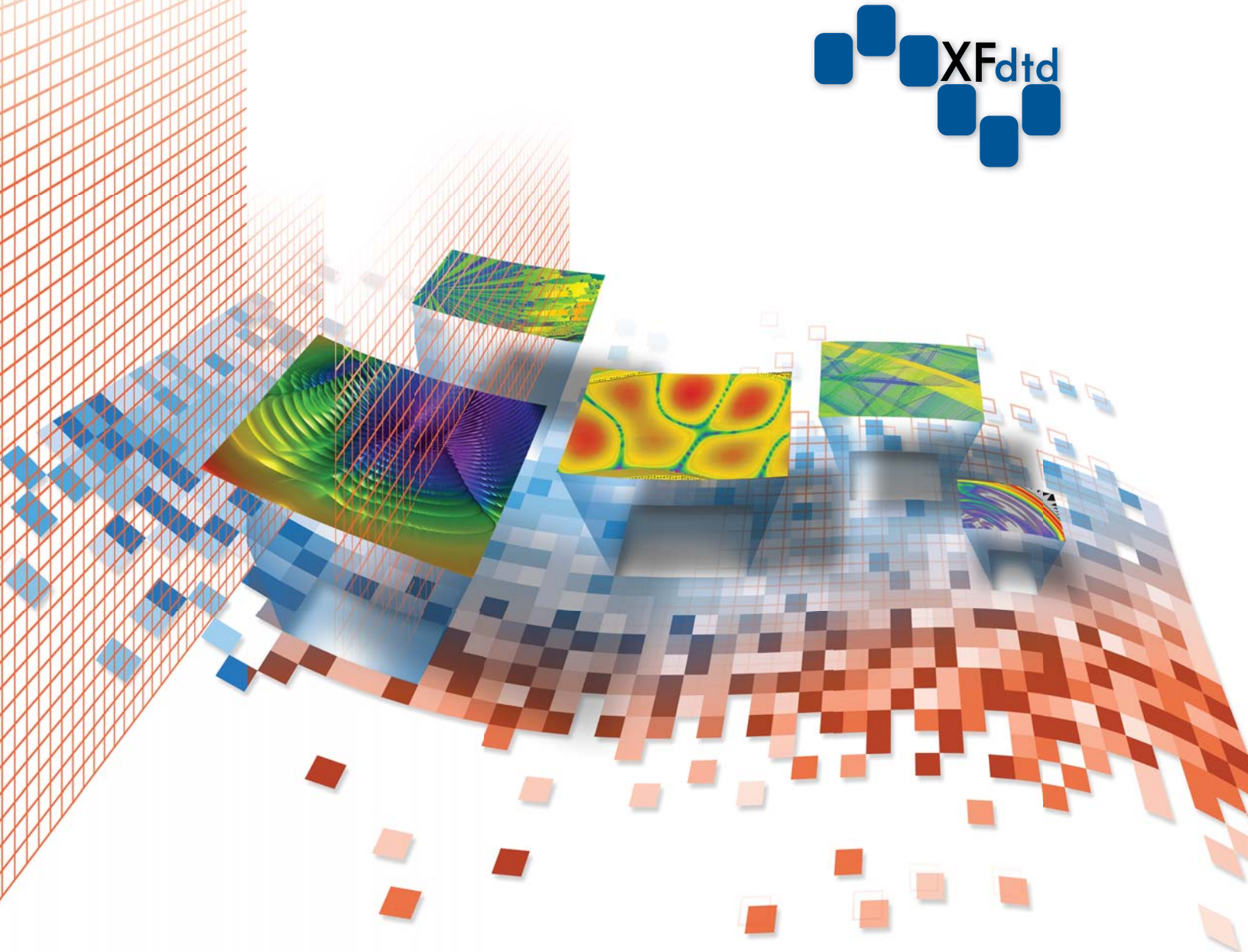
XFdtd® Release 7

Electromagnetic Simulation Simplified



REMCOM®

XFdtd® 7: Fast and Accurate Has Never Been So Easy

CONTENTS

Introduction 3
High Performance Computing 4
XStream GPU Acceleration 5
Powerful Flexible Modeling 6
Simplified Workflow 7
Parameters Everywhere 8
Custom Scripted Features 9
XACT Accurate Cell Technology 10
Results & Output 11
Fast Intelligent Meshing 12
Specifications & Versions 13
The FDTD Method 14
The Remcom Difference 15

Electromagnetic Simulation Solutions for Design Engineers and EM Professionals

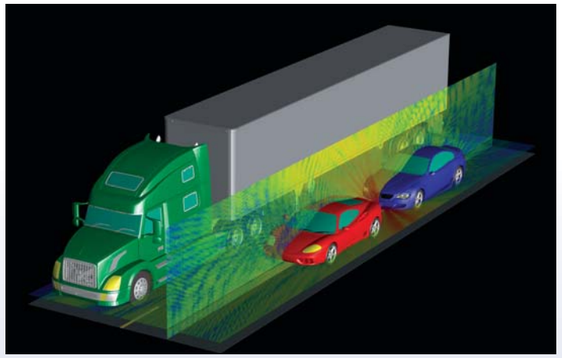
Remcom provides innovative electromagnetic simulation software and consulting services. Our products simplify the analysis of complex EM problems and lead the market in FDTD-based modeling and simulation.

Cell phone antenna design, MRI coil analysis, antenna placement on vehicles and airplanes, and placement of wireless communication systems are made easier with Remcom's EM simulation software and expertise.

Save Time and Streamline Your Work

Remcom continues to focus on the power, speed, and usability that have always been the core strengths of our software. We were one of the earliest innovators to accelerate calculations using the powerful NVIDIA graphics processing units (GPUs) available in modern video cards and we also led the market in developing Message Passing Interface (MPI) technology for GPU clusters. Today, Remcom remains the leader in ultra-fast simulation of very large and complex problems.

Power, Speed, and Usability

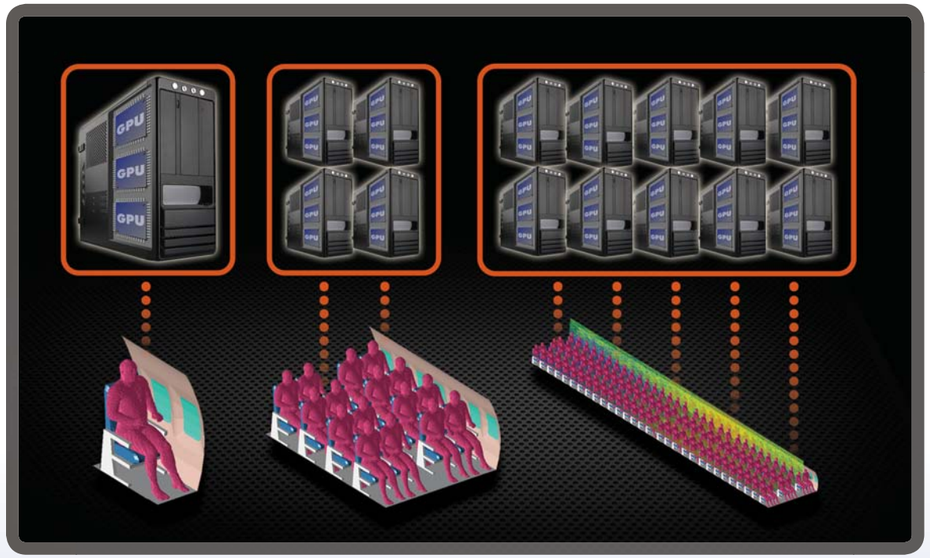


- XStream® GPU Acceleration for CPUs and GPU Clusters. Calculations finish in minutes as compared to hours. Use XStream with the GPUs in a single computer or link multiple GPU clusters in parallel via MPI + GPU technology for massive EM calculations.
- Unlimited Memory Support for problems exceeding 60 GB and billions of cells.
- External Queue Integration (EQI) allows XFdtd users in HPC environments to submit/queue their simulations directly to the compute cluster through the user interface.
- XACT Accurate Cell Technology® resolves the most intricate designs with fewer computational resources.
- CAD Merge seamlessly integrates new versions of CAD and PCB designs into existing projects.
- Powerful Scripting API for creating custom features.

High-Performance Computing Options for Every User

Improve EM simulation performance using the most modern high-performance computing technologies available.

Remcom's industry-leading EM acceleration is a powerful tool to shorten your development time and release your products to market sooner.



Message Passing Interface (MPI) Technology for CPU and GPU Clusters

Distributing XF calculations among CPU and/or GPU clusters creates limitless potential.

Unlimited Memory Support

No memory limits! Simulate massive problems exceeding billions of cells.

Multiprocessor Technology

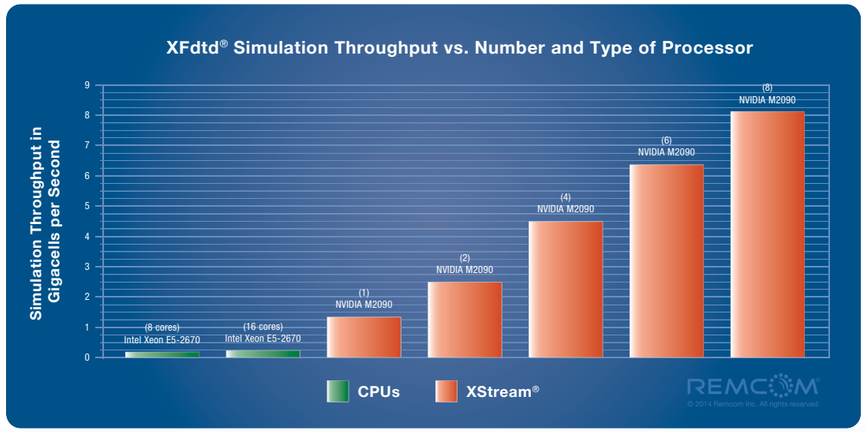
XF calculations are parallelized across all available processors within your computer, greatly speeding calculations.

▶ See examples and learn more at **www.remcom.com/no-limits**

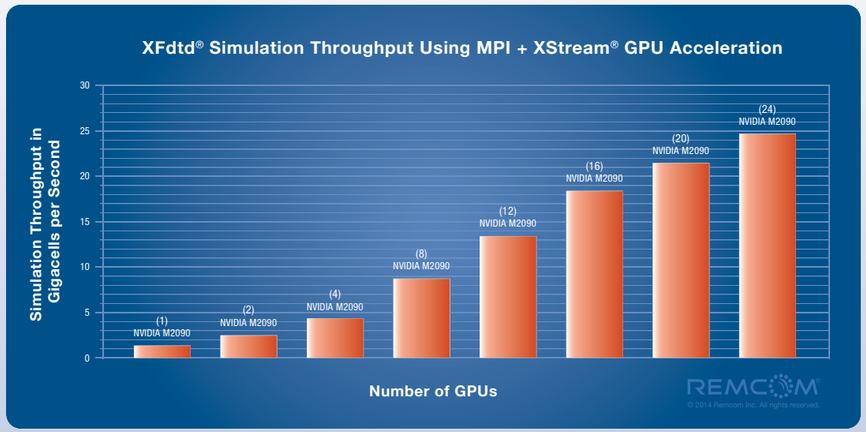
XStream GPU Acceleration

Built-in EM simulation acceleration via graphics processing units.

XStream tremendously improves EM simulation performance by leveraging the powerful NVIDIA graphics processing units (GPUs) available in modern video cards to make ultra-fast FDTD numerical computations. Leveraging NVIDIA's latest generation GPUs, XStream enables XF calculations to finish in minutes as compared to hours or even days using a CPU only.



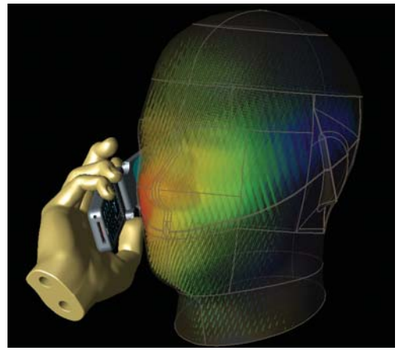
Throughput Plot of XStream.



Throughput Plot of MPI + XStream.

Powerful Flexible Modeling

Spend less time modeling and more time getting results.



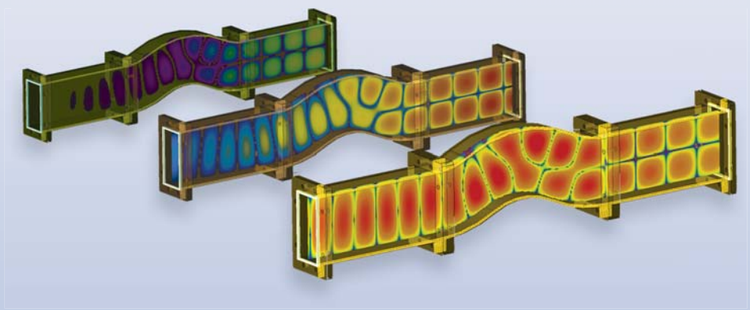
Whether you're importing CAD databases or building your own models, the sophisticated modeling tools in XF7 will make your job easier. The modeling engine in XF7 allows you to build complicated models from the ground up or modify imported CAD files. This reduces the amount of time you spend modeling, leaving you more time to focus on your results.

Key Features

- 2D Sketcher with constraints
  Intuitive grid/object snapping and a constraint system allow for quick creation of complex shapes.
- Feature history for objects
  Modeling operations are chained together on each object, creating an editable history for each model in your project.

Importable CAD Formats

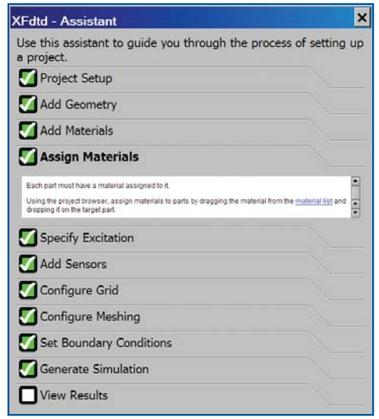
- ODB++
- SAT/SAB
- DXF
- VDA-FS
- STEP
- IGES
- Pro/E
- CATIAv4
- CATIAv5
- Inventor



Simplified Workflow

XF7 streamlines your workflow by eliminating time-consuming, redundant tasks.

XF7 multiplies your productivity by allowing you to reuse almost anything you create. Any project can be turned into a template, the parts of your project can be stored in a shared library, and any simulation you do is saved and the results easily accessed for comparison purposes.



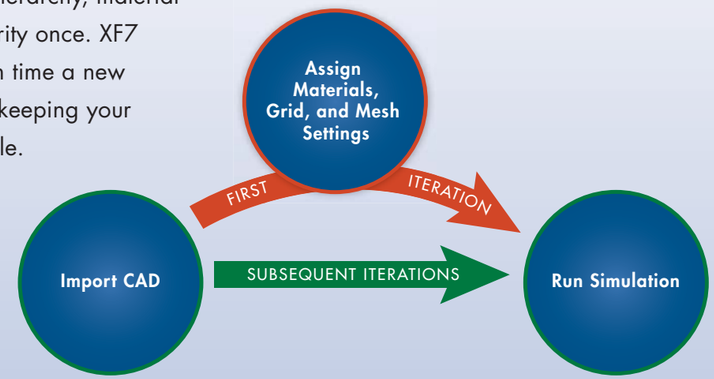
XF's Assistant is a step-by-step guide that speeds the learning curve for new users.

Key Features

- Custom project templates
- Simulation history with all results
- Shared libraries
- Shared component, sensor, and waveform definitions
- PCB Merge for importing layered PCBs in ODB++
- CAD Merge

CAD Merge

If you work with frequently updated CAD files, you'll only have to set up the hierarchy, material assignments and meshing priority once. XF7 preserves this information each time a new version of the file is imported, keeping your workflow as efficient as possible.



CAD Merge compares the new geometry with the original and automatically refreshes the project tree with the changes.

Parameters Everywhere

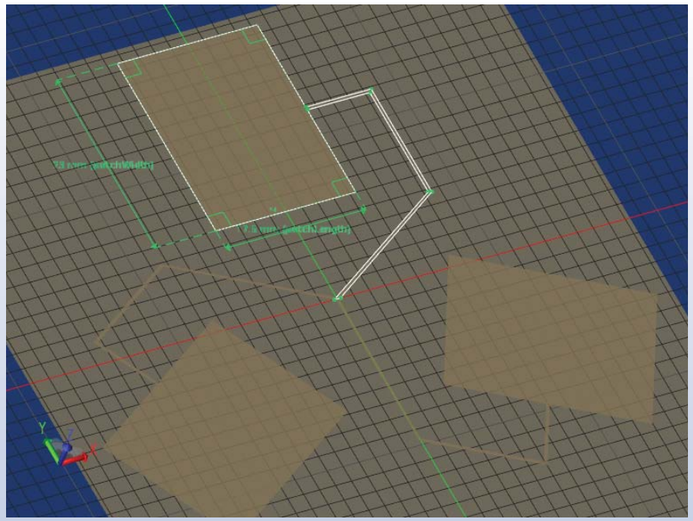
XF7 helps you find the optimal solution.

In XF7, parameters are part of the DNA of a project. Parts, components, waveforms, materials and just about everything else in your project can leverage the power of parameters. It's simple enough for anyone to use, but with some advanced capabilities that will make any power user happy.

Key Features

- Define nearly any variable value as a parameter, such as the length of a part or the frequency of a simulation
- Mathematical expressions using parameters
- Interface with scripts for parameter evaluation

Entire assemblies based on the same parameter can be modified by changing one value. Since parameters can be used almost anywhere in XF7, you can automate more things and gain complete control of your projects.

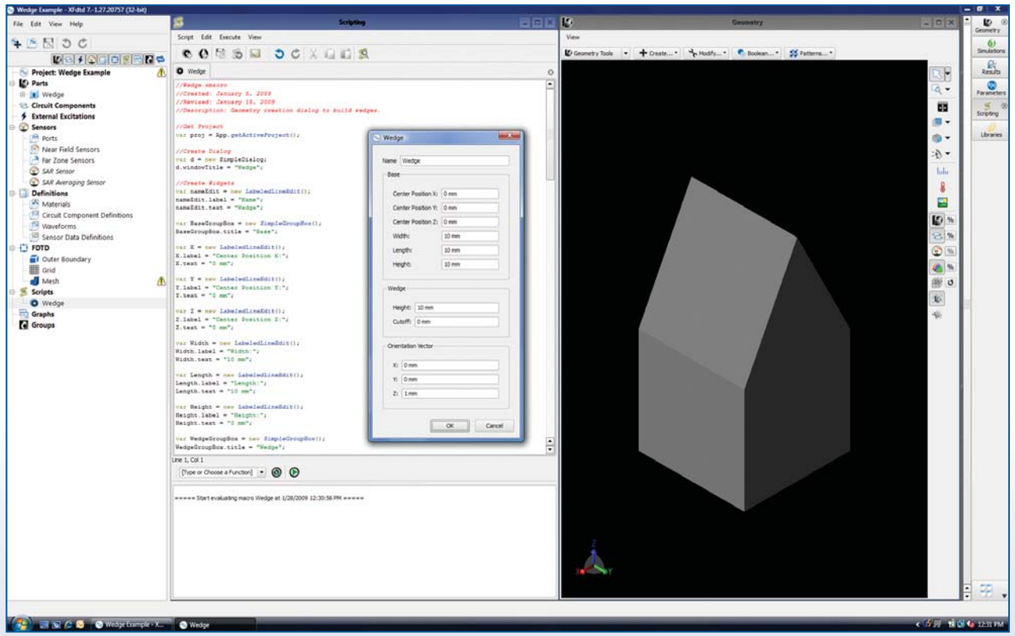


Example uses include tuning an antenna by parameterizing the length and width to achieve a desired response.

Custom Scripted Features

XF7 allows you to create your own custom features with a powerful scripting API.

With XF7, the power is in your hands to create time-saving, custom features that allow you to work faster. Nearly everything in the application can be controlled and accessed through a powerful scripting API. Whether you're writing custom dialogs or designing custom optimization routines, the scripting API in XF7 breaks down the walls between what you have and what you need.



Key Features

- Full-featured Script Editor
- Custom dialog creation through scripts

The XTend Script Library helps adapt XF7 to your unique processes to extend the functionality of the tool. The scripts packaged with the application are available for you to modify and fit to your own needs. Remcom's support team is also available to customize scripts for your specific use; contact Remcom for a quote.

XACT Accurate Cell Technology

Faster, more accurate simulations.

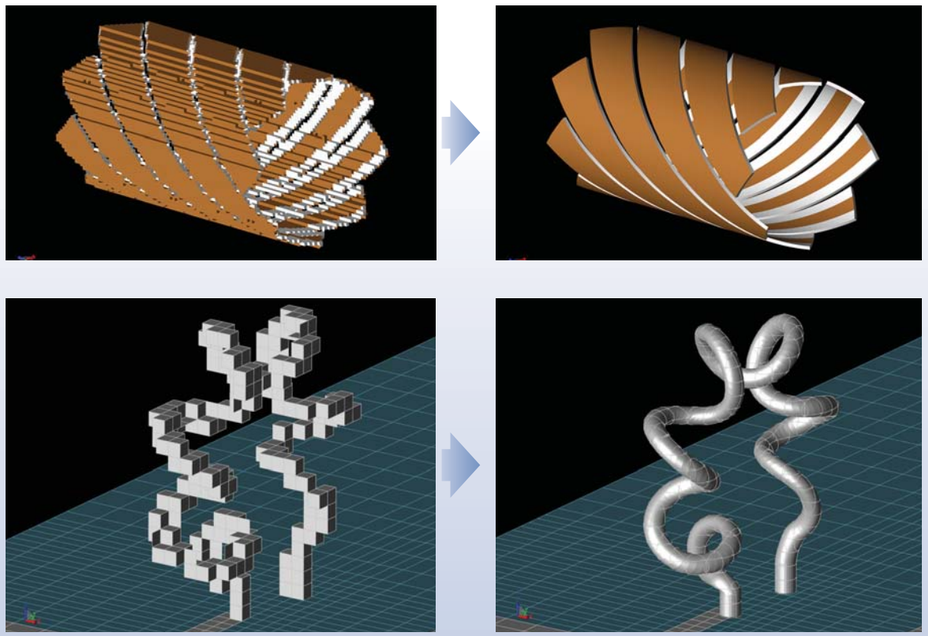
With XF7, there is no need to choose performance over accuracy. XACT mesh reduces simulation time while improving the accuracy of even the most intricate designs. Using an advanced sub-cellular conformal method, XF7 reduces computing resources while maintaining the accuracy of a full wave solver. Faster, more accurate simulations improve the throughput of your designs from start to finish.

Key Features

- Represents small gaps and curved surfaces
- Increases accuracy of results
- Significantly improves simulation time by reducing unknowns

Traditional FDTD Mesh

XACT Mesh



Comparisons show the dramatic improvement with XACT, improving the throughput of your designs.

Results & Output

Complete result history.

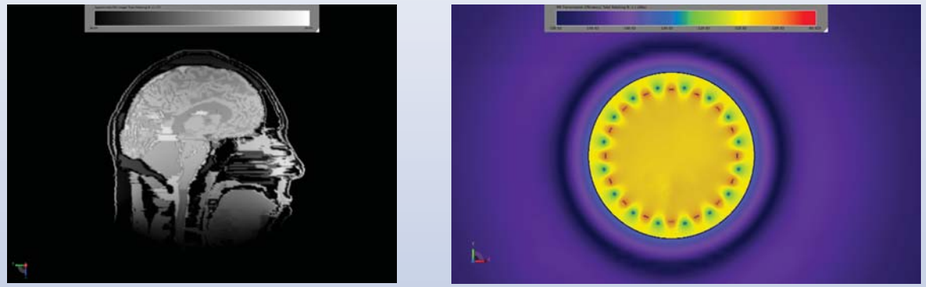
XF7 was designed to support the way you work by keeping track of every simulation you do for each project. Results from other projects or past simulations can be added to graphs, viewed in 3D, post-processed, or exported to text files. The Results Browser in XF7 is completely customizable, and filtering and searching tools make it easy to find exactly what you're looking for with a few clicks.

Visual Output

- Planes, surfaces and volumes of output shown with input geometry
- E/H/B, conduction current, rotating B near fields, in addition to dissipated power density
- 3D far field patterns of E, gain, realized gain, axial ratio, radar cross section
- Hearing aid compatibility, SAR, MR transmit efficiency, and approximate MR image outputs
- Biological temperature rise

Graphical Output

- Near zone fields/currents vs. time
- Impedance, S-Parameters vs. frequency, VSWR, active VSWR
- Polar plot antenna patterns
- Smith chart impedance plots
- FFT of transient results
- Group Delay output type
- Time Domain Reflectometry (TDR) and Time Domain Transmission (TDT) output types
- Dissipated Power Density



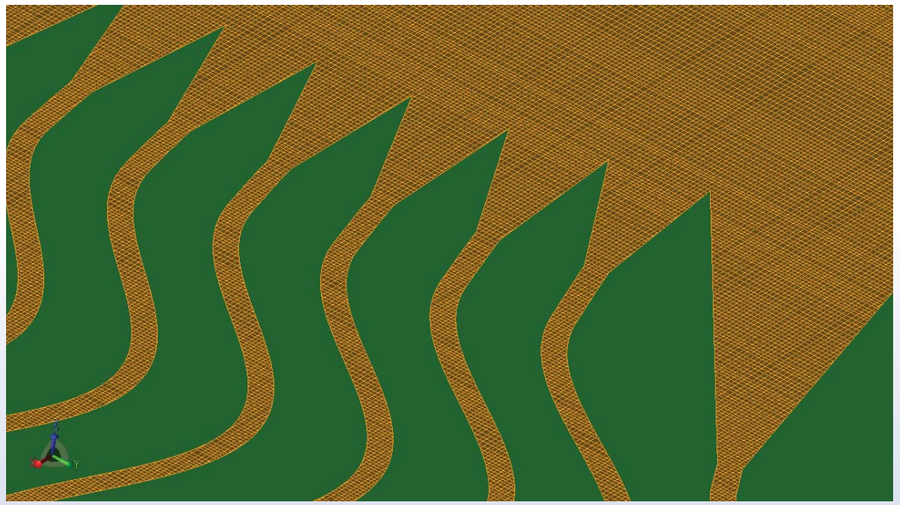
Approximate MR image and transmit efficiency visual output types.

Fast Intelligent Meshing

XF7 makes it easier to generate more accurate and efficient meshes with less work.

XFdtd has always led the market with the ability to see the finished mesh with materials before the simulation ever starts. This provides the confidence that the simulation will not fail due to a meshing error. XF7's intelligent and ultra-fast mesh updating capabilities make this process even more seamless than before.

Meshes that previously would have been too large to view can now be created and inspected in a fraction of the time. XF7 intelligently updates the mesh only when and where it's required, allowing you to create the most accurate and efficient mesh with fewer interruptions. This also ensures that your project will have the smallest mesh necessary to perform an accurate simulation.



Key Features

- View mesh before simulation
- Automatic fixed point insertion
- Automatic grid regions
- Fast meshing speed
- Small memory footprint for large meshes

Specifications & Versions

There are three versions of XFdtd available, Limited, Professional, and Bio-Pro. Bio-Pro is a specialty version of XF that includes capabilities for bio-EM calculations. All versions include 64-bit analysis module, geometric modeler and postprocessor, as well as shared memory multiprocessor (MPM) capability. The following chart shows a comparison of available features in each version:

XFdtd Versions Comparison

	Limited	Pro	Bio-Pro
XStream GPU Acceleration Tokens	0	1	2
MPM Tokens	4	16	32
3D CAD Modeling	•	•	•
Parameterization & Scripting	•	•	
CAD and PCB Import*	SAT, SAB, DXF only	•	•
XACT Accurate Cell Technology		•	•
Specific Absorption Rate (SAR)			•
VariPose Mesh Repositioning			•
Birdcage Tool			•
Floating Licenses		•	•

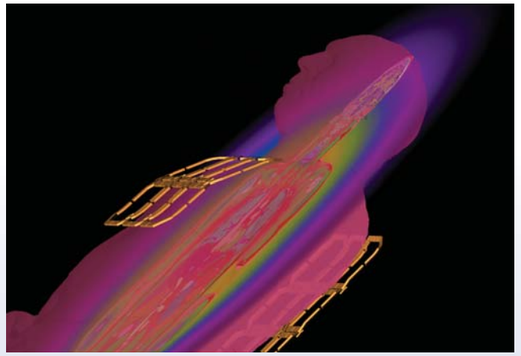
* Pro and Bio-Pro import types: ODB++, SAT/SAB, DXF, VDA-FS, STEP, IGES, Pro/E, CATIAv4, CATIAv5, Inventor
XFdtd runs on Windows and Linux.

High performance computing packages are also available, including Cluster and Enterprise bundles for very large GPU, MPI, and MPM distributed memory installations. Please contact Remcom for pricing.

Why Use the FDTD Method?

While many electromagnetic simulation techniques are applied in the frequency-domain, FDTD solves Maxwell's equations in the time domain. This means that the calculation of the electromagnetic field values progresses at discrete steps in time. One benefit of the time domain approach is that it gives broadband output from a single execution of the program; however, the main reason for using the FDTD approach is the excellent scaling performance of the method as the problem size grows. As the number of unknowns increases, the FDTD approach quickly outpaces other methods in efficiency.

FDTD has also been identified as the preferred method for performing electromagnetic simulations for biological effects from wireless devices [1]. The FDTD method has been shown to be the most efficient approach and provides accurate results of the field penetration into biological tissues.



[1] C95.3.2002, *Recommended Practice for Measurements and Computations with Respect to Human Exposure to Radio Frequency Electromagnetic Fields*, 100kHz to 300GHz. IEEE Standards and Coordinating Committee 28 on Non-Ionizing Radiation Hazards, April 2002.

The Remcom Difference

Customer Focused

Remcom is devoted to listening to our customers and understanding their needs, building requested features directly into the software with each new release. And since we've been providing EM expertise and solutions since simulation software became a reality, you can be confident that many years of experience have gone into the design and functionality of the products we create and the way we support them.

Personal Attention

Our reputation for providing excellent and accessible technical support is a result of the talent we recruit and our willingness to put our best people in touch with customers in need. Remcom makes our most respected engineers accessible for issues that go beyond basic support.

An Enjoyable Business Collaboration — it's just as important as the software you choose.

Remcom's focus on the customer, EM expertise, and agile corporate culture give us an edge over larger corporations and make doing business with us hassle-free and enjoyable.

A Sampling of Our Customers

3M	IBM	Toshiba
BAE Systems	LG	Toyota
Cobham	Lockheed Martin	U.S. Food and Drug
Dynetics	Mitsubishi	Administration (FDA)
Ericsson	Nokia	United States Air Force
GE	Samsung	United States Army
General Motors	Siemens	United States Marines
Honda	Sony	United States Navy
Honeywell	Texas Instruments	

▶ See **www.remcom.com/customers** for more.

Remcom Discussion Forum

Remcom's Discussion Forum allows you to engage with other EM Simulation professionals and Remcom's own experts. Go to **www.remcom.biz/forum** to view discussions as a guest, or join the community to participate and post your own comments. Registration is fast and free!

User Tips

Our engineers write short, monthly tips for using XF7 more efficiently.
Visit **www.remcom.com/remcom-user-tips** for these mini-tutorials.

Remcom has been leading the EM market with innovative simulation and wireless propagation tools for 20 years. In addition to our flagship product, XFdtd, we offer a suite of innovative software and services, accessible and responsive support provided by a staff of experts, and comprehensive training. Our family of products includes:

XFdtd®: 3D EM simulation software package that provides engineers with powerful and innovative tools for modeling and EM software simulation.

XStream®: GPU acceleration using NVIDIA's CUDA architecture dramatically speeds numerical computations.

XGtd®: A high frequency GTD/UTD based package for the design and analysis of antenna systems on complex objects such as vehicles and aircraft.

Wireless InSite®: A radio propagation analysis package for analyzing the impact of the physical environment on the performance of wireless communication systems.

VariPose®: A geometric modeling package for the manipulation and refining of high-resolution human mesh models for the medical and biomedical markets.

Rotman Lens Designer®: A tool for the design, synthesis, and analysis of Rotman Lenses.

REMCOM®

Visit **www.remcom.com** for more information

Remcom, Inc.
315 S. Allen St., Suite 416
State College, PA 16801 USA

+1.888.7.REMCOM (US/CAN)
+1.814.861.1299 phone
+1.814.861.1308 fax

sales@remcom.com

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XF7.3-2-0314