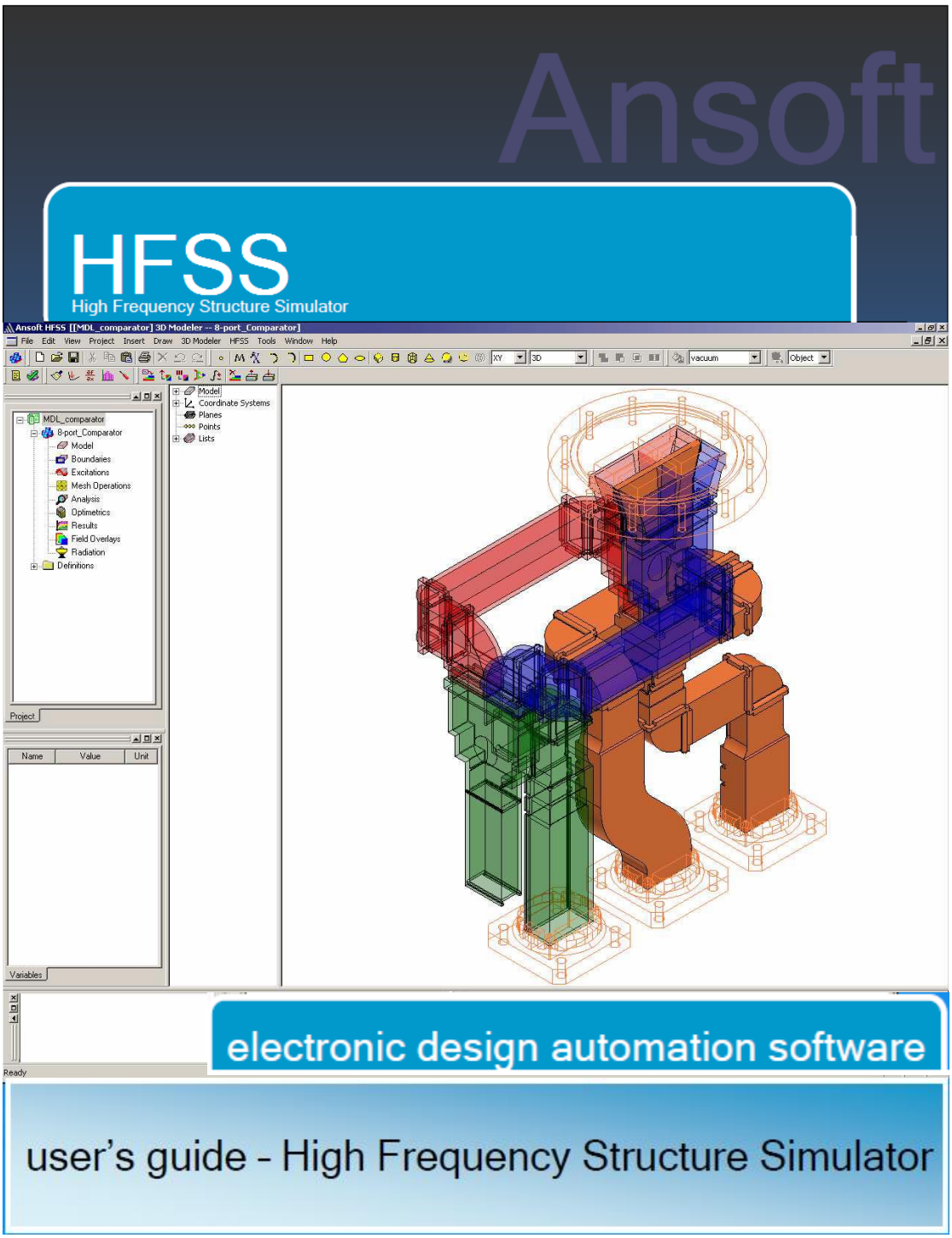
Experiment No. 1

Introduction to HFSS



Ansoft HFSS Fundamentals:

HFSS is a high-performance full-wave electromagnetic (EM) field simulator for arbitrary 3D volumetric passive device modeling that takes advantage of the familiar Microsoft Windows graphical user interface. It integrates simulation, visualization, solid modeling, and automation in an easy-to-learn environment where solutions to your 3D EM problems are quickly and accurately obtained. Ansoft HFSS employs the Finite Element Method (FEM), adaptive meshing, and brilliant graphics to give you unparalleled performance and insight to all of your 3D EM problems. Ansoft HFSS can be used to calculate parameters such as S Parameters, resonant frequency, and fields. Typical uses include:

Package Modeling– BGA, QFP, Flip-Chip

PCB Board Modeling– Power/Ground planes, Mesh Grid Grounds, Backplanes

Silicon/GaAs– Spiral Inductors, Transformers

EMC/EMI– Shield Enclosures, Coupling, Near- or Far-Field Radiation

Antennas/Mobile Communications – Patches, Dipoles, Horns, Conformal Cell Phone Antennas, Quadrafilar Helix, Specific Absorption Rate (SAR), Infinite Arrays, Radar Cross Section (RCS), Frequency Selective Surfaces (FSS)

Connectors – Coax, SFP/XFP, Backplane, Transitions

Waveguide – Filters, Resonators, Transitions, Couplers

Filters – Cavity Filters, Microstrip, Dielectric

HFSS is an interactive simulation system whose basic mesh element is a tetrahedron. This allows you to solve any arbitrary 3D geometry, especially those with complex curves and shapes, in a fraction of the time it would take using other techniques.

The name HFSS stands for High Frequency Structure Simulator. Ansoft

pioneered the use of the Finite Element Method(FEM) for EM simulation by developing/implementing technologies such as tangential vector finite elements, adaptive meshing, and Adaptive Lanczos-Pade Sweep(ALPS). Today, HFSS continues to lead the industry with innovations such as Modes-to-Nodes and Full- Wave Spice™.

Ansoft HFSS has evolved over a period of years with input from many users and industries. In industry, Ansoft HFSS is the tool of choice for high-productivity research, development, and virtual prototyping.

Visiting the Ansoft Web Site:

If your computer is connected to the Internet, you can visit the Ansoft Web site to learn more about the Ansoft company and products.

From the Ansoft Desktop

Select the menu itemHelp>Ansoft Corporate Website to access the Online Technical Support (OTS) system.

From your Internet browser, Visit www.ansoft.com

Ansoft Terms:

The Ansoft HFSS window has several optional panels:

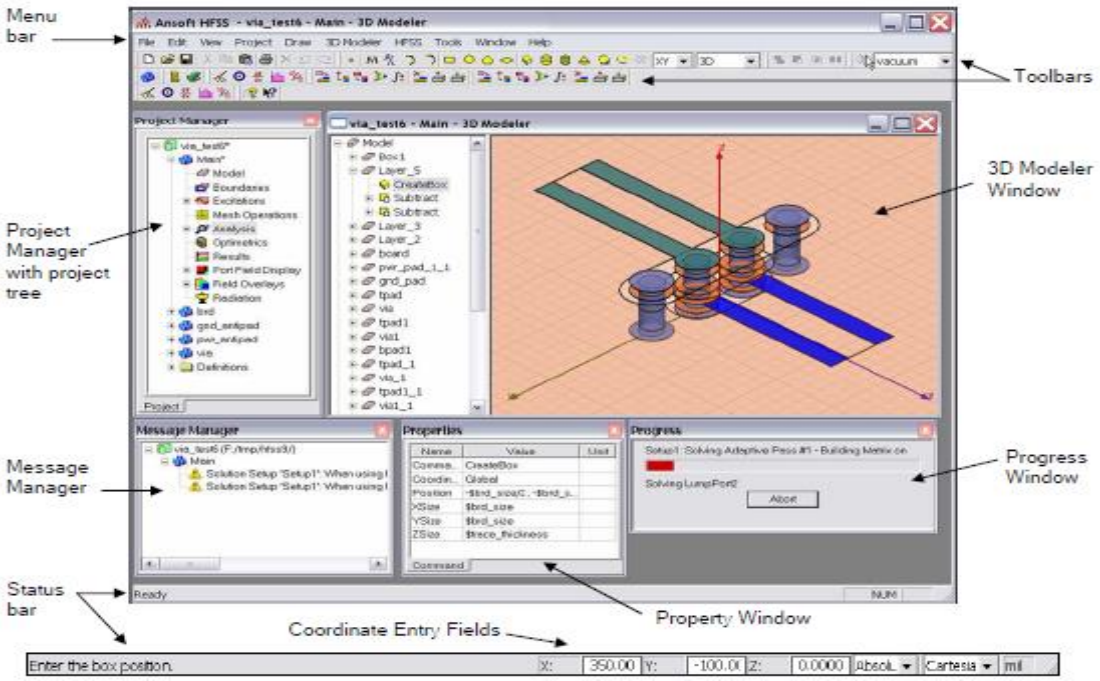
A **Project Manager** which contains a design tree which lists the structure of the project.

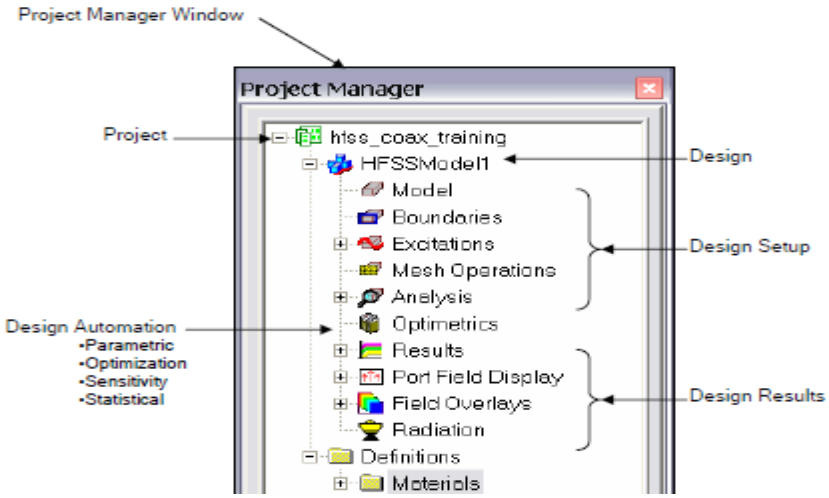
A **Message Manager** that allows you to view any errors or warnings that occur before you begin a simulation.

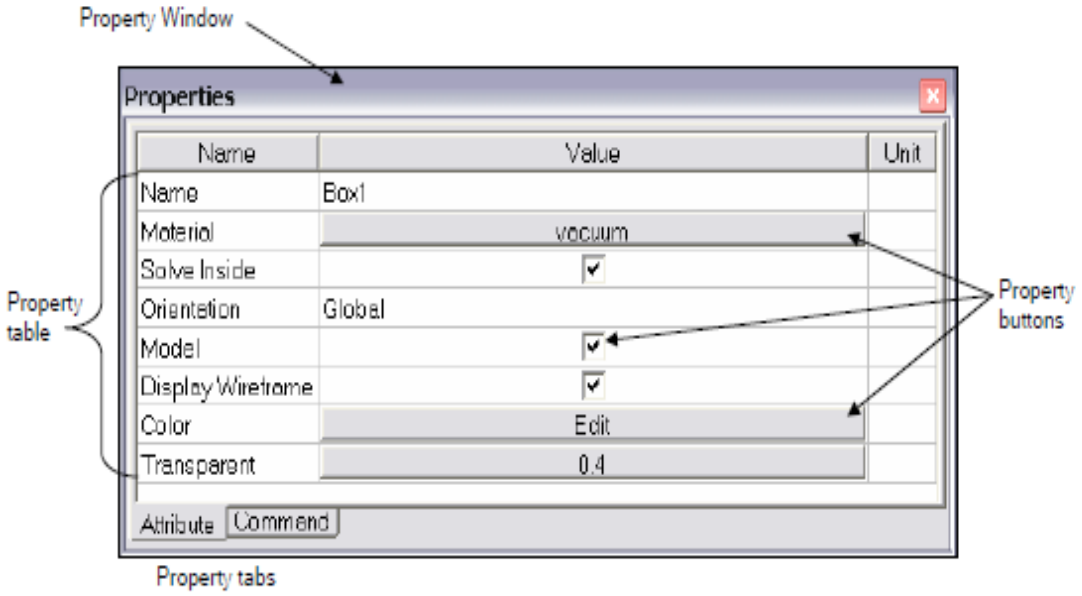
A **Property Window** that displays and allows you to change model parameters or attributes.

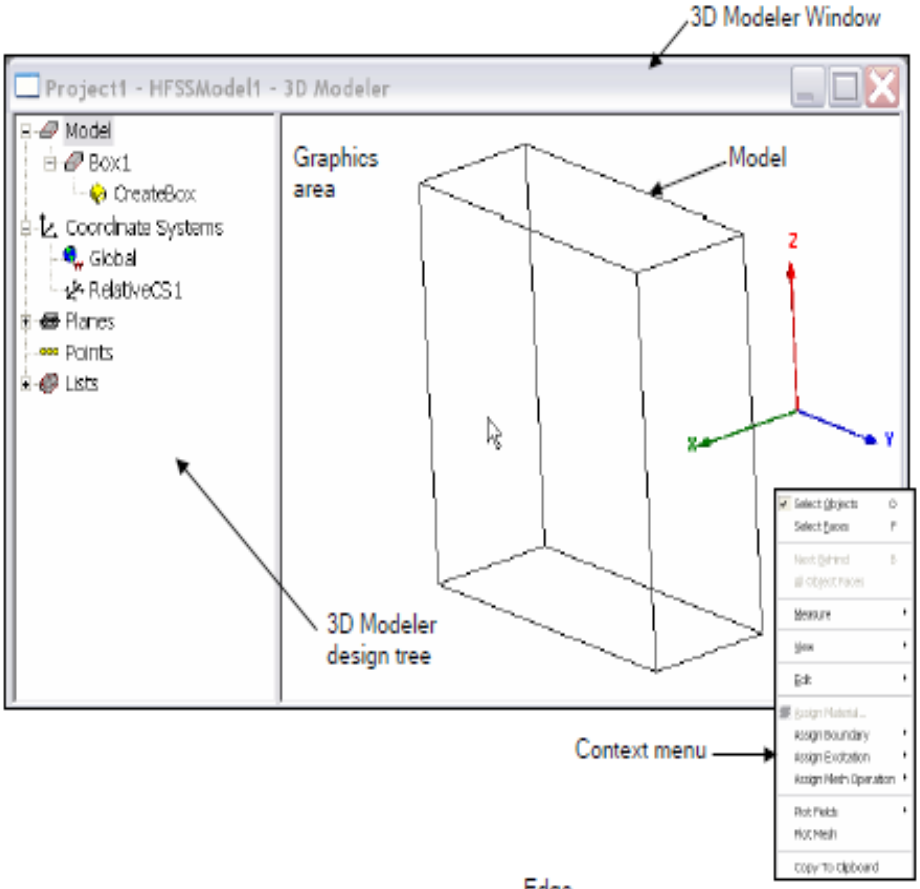
A **Progress Window** that displays solution progress.

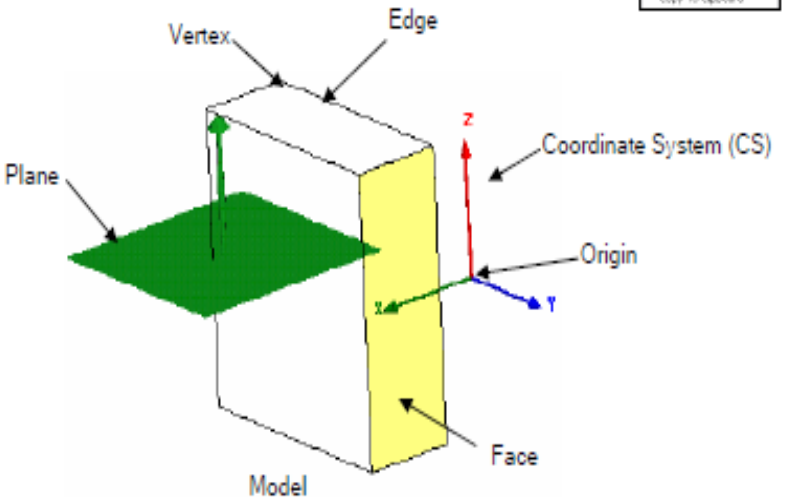
A **3D Modeler Window** which contains the model and model tree for the active design.

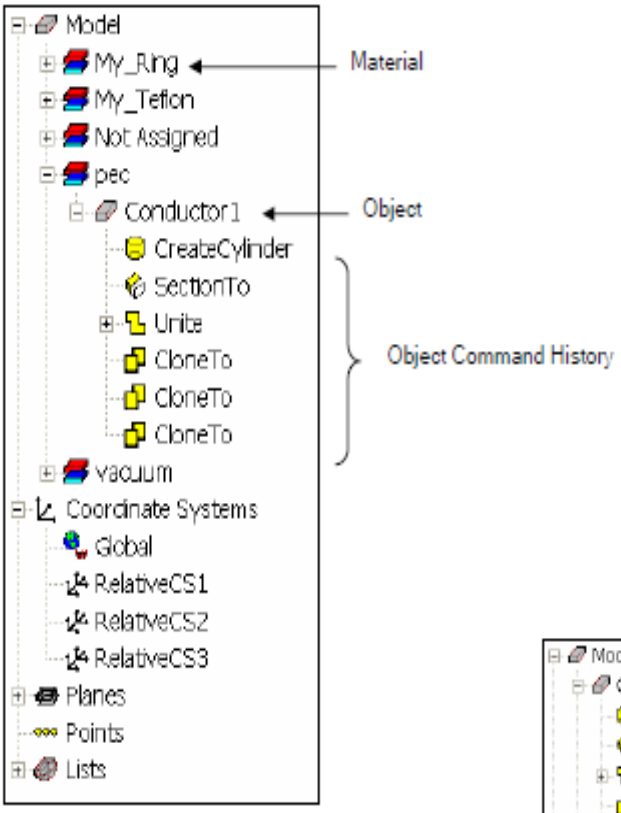

Menu bar
Toolbars
3D Modeler Window
Project Manager with project tree
Message Manager
Progress Window
Status bar
Property Window
Coordinate Entry Fields
Enter the box position.


Project Manager Window
Project Manager
Project
hfss_coax_training
Design
HFSSModel1
Model
Boundaries
Excitations
Mesh Operations
Analysis
Design Setup
Design Automation
•Parametric
•Optimization
•Sensitivity
•Statistical
Optimetrics
Results
Port Field Display
Field Overlays
Radiation
Design Results
Definitions
Materials

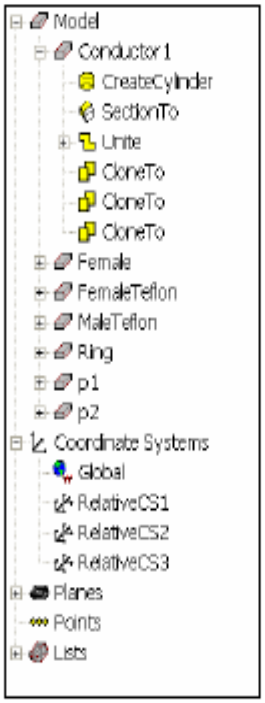

Property Window
Properties
Name
Value
Unit
Name
Box1
Material
vacuum
Solve Inside
Orientation
Global
Model
Display Wireframe
Color
Edit
Transparent
0.4
Attribute
Command
Property table
Property buttons
Property tabs


3D Modeler Window
Project1 - HFSSModel1 - 3D Modeler
Model
Box1
CreateBox
Coordinate Systems
Global
RelativeCS1
Planes
Points
Lists
Graphics area
Model
Z
Y
X
3D Modeler design tree
Context menu


Vertex
Edge
Plane
Z
Coordinate System (CS)
Origin
X
Y
Face
Model



Grouped by Material



Object View

Design Windows:

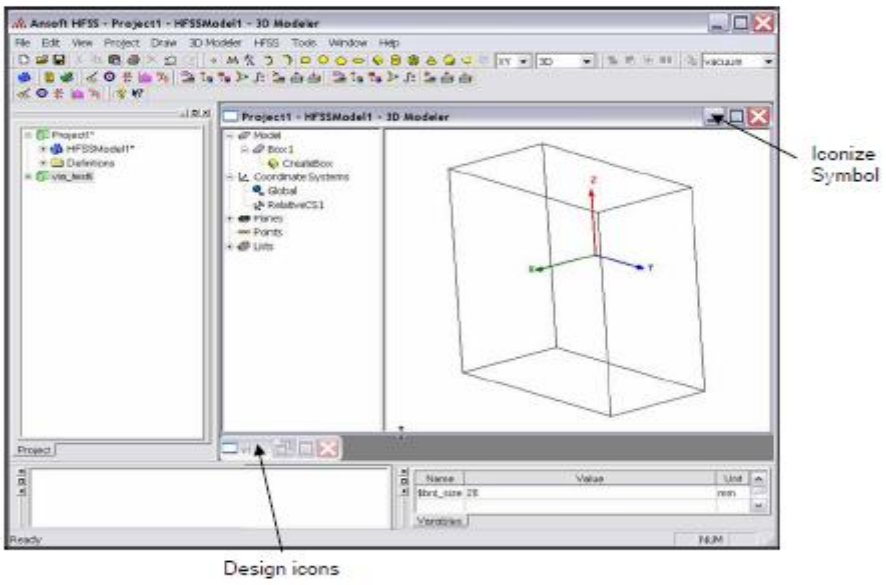
In the Ansoft HFSS Desktop, each project can have multiple designs and each design is displayed in a separate window.

You can have multiple projects and design windows open at the same time. Also, you can have multiple views of the same design visible at the same time.

To arrange the windows, you can drag them by the title bar, and resize them by dragging a corner or border. Also, you can select one of the following menu options: Window >Cascade, Window >Tile Vertically, or Window > Tile Horizontally.

To organize your Ansoft HFSS window, you can iconize open designs. Click the Iconize ** symbol in the upper right corner of the document border. An icon appears in the lower part of the Ansoft HFSS window. If the icon is not visible, it may be behind another open document. Resize any open documents as necessary. Select the menu item Window > Arrange Icons to arrange them at the bottom of the Ansoft HFSS window.

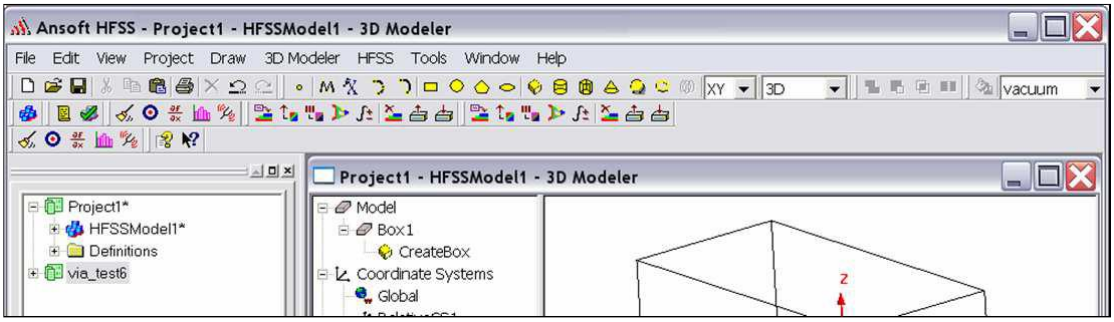
Select the menu item Window > Close All to close all open design. You are prompted to Save unsaved designs.



Toolbars:

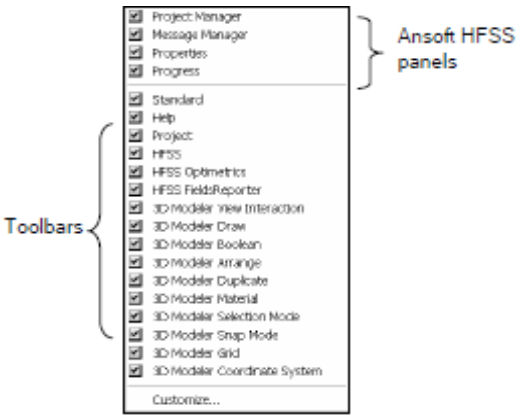
The toolbar buttons are shortcuts for frequently used commands. Most of the available toolbars are displayed in this illustration of the Ansoft HFSS initial screen, but your Ansoft HFSS window probably will not be arranged this way. You can customize your toolbar display in a way that is convenient for you.

Some toolbars are always displayed; other toolbars display automatically when you select a document of the related type. For example, when you select a 2D report from the project tree, the 2D report toolbar displays.



To display or hide individual toolbars:

Right-click the Ansoft HFSS window frame. A list of all the toolbars is displayed. The toolbars with a check mark beside them are visible; the toolbars without a check mark are hidden. Click the toolbar name to turn its display on or off. To make changes to the toolbars, select the menu item Tools > Customize. See Customize and Arrange Toolbars on the next page.

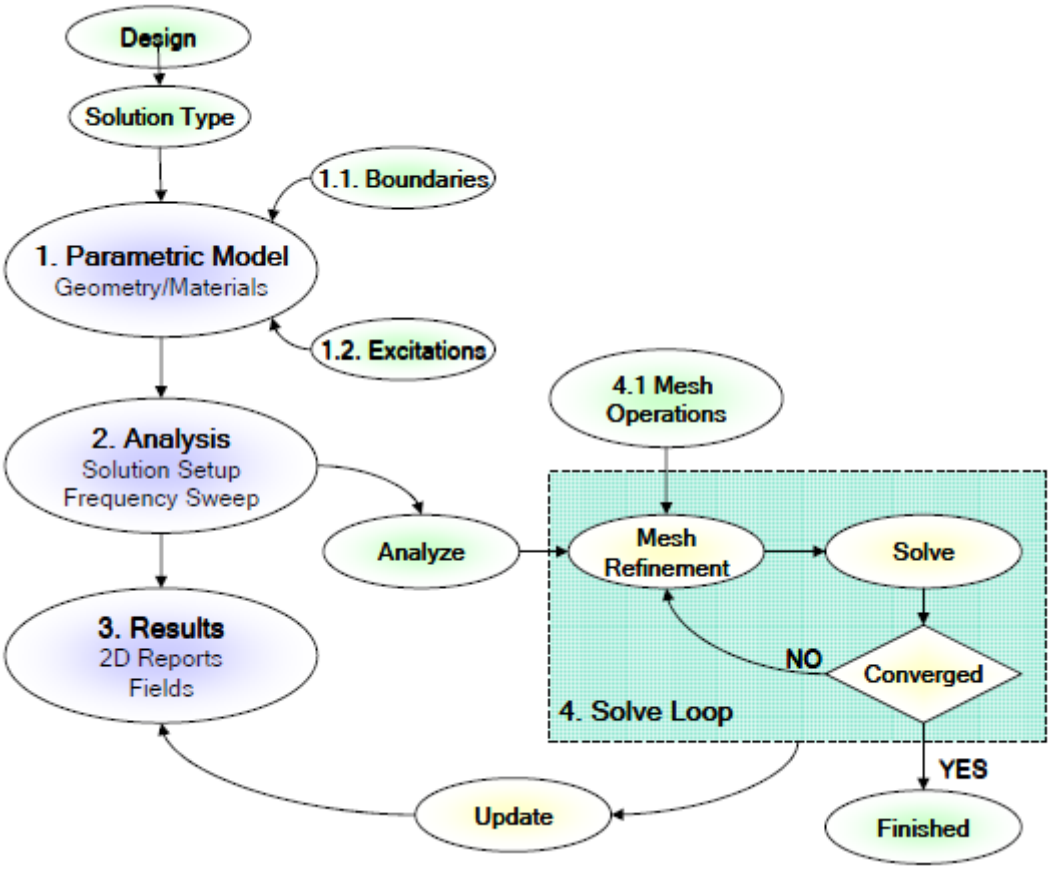


Ansoft HFSS Desktop:

The Ansoft HFSS Desktop provides an intuitive, easy-to-use interface for developing passive RF device models. Creating designs, involves the following:

1. Parametric Model Generation – creating the geometry, boundaries and excitations.
2. Analysis Setup – defining solution setup and frequency sweeps.
3. Results – creating 2D reports and field plots.
4. Solve Loop - the solution process is fully automated.

To understand how these processes co-exist, examine the illustration shown below.



Opening a HFSS project:

This section describes how to open a new or existing project.

Opening a New project

To open a new project:

1. In an Ansoft HFSS window, select the menu item File > New.
2. Select the menu Project > Insert HFSS Design.

Opening an Existing HFSS project

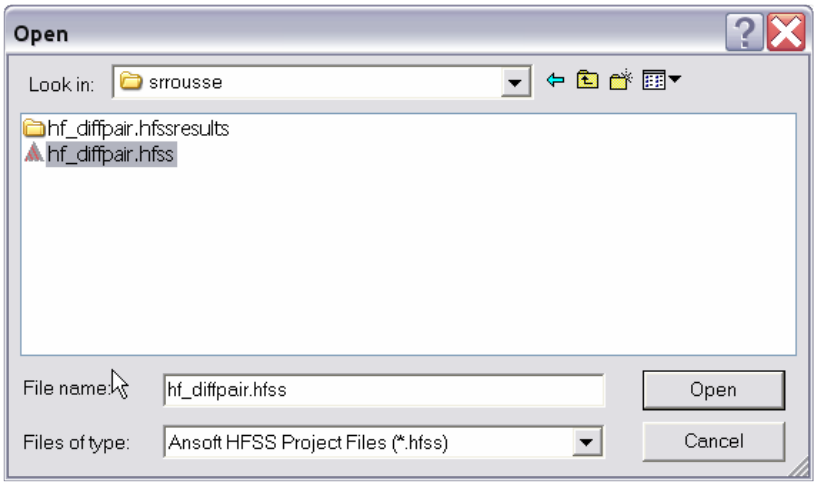
To open an existing project:

1. In an Ansoft HFSS window,

Select the menu File > Open.

Use the Open dialog to select

2. Click Open to open the project



Opening an Existing Project from Explorer

You can open a project directly from the Microsoft Windows Explorer. To open a project from Windows Explorer, do one of the following:

Double-click on the name of the project in Windows Explorer.

Right-click the name of the project in Windows Explorer and select Open from the shortcut menu.