Overview
The Process

1. Parametric Model
   - Geometry/Materials

2. Analysis
   - Solution Setup
   - Frequency Sweep

3. Results
   - 2D Reports
   - Fields

4. Solve Loop
   - Mesh Refinement
   - Converged

   - Solve
   - Finished
   
   - YES
   - NO
   - Update
Overview

Initial Solution

- Initial Mesh
- Seeding and Lambda Refinement (Single Frequency)
- Port Solution (Adaptive)

Full Volumetric Solution (S-Parameters/E-Fields)

Adaptive Mesh Loop

- Refine Mesh (Gradient of E-Field at Single Frequency)
- Check Convergence (Delta S)

Port Solution (Adaptive)

- Frequency Sweep
- Ports Only & Frequency Sweep
- No Adaptive Meshing
Starting HFSS
- Click the Microsoft Start button, select Programs, and select the Ansoft > HFSS 9 > HFSS 9.
- Or Double click on the HFSS 9 icon on the Windows Desktop

Adding a Design
- When you first start HFSS a new project will be automatically added to the Project Tree.
- To add an HFSS Design to the project, select the menu item Project > Insert HFSS Design
Overview

Ansoft Desktop

Menu bar

Toolbars

3D Modeler Window

Project Manager with project tree

Message Manager

Progress Window

Status bar

Coordinate Entry Fields

Property Window
Ansoft Desktop - Project Manager

- Multiple Designs per Project
- Multiple Projects per Desktop
- Integrated Optimetrics Setup
  - Requires License for Analysis

![Project Manager Window](image)

- Design Automation
  - Parametric
  - Optimization
  - Sensitivity
  - Statistical

- Design
- Design Setup
- Design Results

- Project Manager Window
  - hfss_coax_training
  - HFSSModel1
  - Model
  - Boundaries
  - Excitations
  - Mesh Operations
  - Analysis
  - Optimetrics
  - Results
  - Port Field Display
  - Field Overlays
  - Radiation
  - Definitions
  - Materials
Overview

Ansoft Desktop - 3D Modeler

3D Modeler Window

3D Modeler design tree

Graphics area

Model

Coordinate System (CS)

Origin

Face

Edge

Vertex

Plane

Model

Context menu

Select Objects
Select Faces
Next Behind
All Object Faces
Measure
View
Edit
assign Material
Assign Boundary
Assign Excitation
Assign Mesh Operation
Plot Fields
Plot Mesh
Copy To Clipboard
Overview

- **Set Solution Type**
  - **To set the solution type:**
    1. Select the menu item **HFSS > Solution Type**
    2. Solution Type Window:
       1. Choose **Driven Modal**
       2. Click the **OK** button

- **HFSS - Solution Types**
  - **Driven Modal** - calculates the modal-based S-parameters. The S-matrix solutions will be expressed in terms of the incident and reflected powers of waveguide modes.
  - **Driven Terminal** - calculates the terminal-based S-parameters of multi-conductor transmission line ports. The S-matrix solutions will be expressed in terms of terminal voltages and currents.
  - **Eigenmode** - calculates the eigenmodes, or resonances, of a structure. The Eigenmode solver finds the resonant frequencies of the structure and the fields at those resonant frequencies.

- **Convergence**
  - **Driven Modal** - Delta S for modal S-Parameters. This was the only convergence method available for Driven Solutions in previous versions.
  - **Driven Terminal** - Delta S for the single-ended or differential nodal S-Parameters.
  - **Eigenmode** - Delta F
**Overview**

- **Set Model Units**
  - **To set the units:**
    1. Select the menu item **3D Modeler > Units**

- **Set Default Material**
  - **To set the default material:**
    1. Using the 3D Modeler Materials toolbar, choose **Select**
    2. Select Definition Window:
       1. Type **pec** in the **Search by Name** field
       2. Click the **OK** button
3D Modeler - Create a Primitive

The Coordinate Entry fields allow equations to be entered for position values.

- Variables are not allowed in the Coordinate Entry Field
- Note: Trig functions are in radians

Examples: 2*5, 2+6+8, 2*cos(10°*(pi/180)).
Overview

3D Modeler - Object Properties

Attributes

Commands

Properties: Project22 - HFSSModel1 - 3D Modeler

<table>
<thead>
<tr>
<th>Command</th>
<th>Attribute</th>
<th>Value</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>CreateBox</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordinate System</td>
<td>Global</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td>-1, -22, 0</td>
<td>mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>XSize</td>
<td>2</td>
<td>mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YSize</td>
<td>2.4</td>
<td>mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZSize</td>
<td>0.6</td>
<td>mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OK Cancel

Properties: Project22 - HFSSModel1 - 3D Modeler

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Unit</th>
<th>Description</th>
<th>Read-only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Box1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>vacuum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solve Inside</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Global</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display Wireframe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>Edit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transparent</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OK Cancel

Ansoft High Frequency Structure Simulator v 9.0 - Training Seminar
**Overview**

### 3D Modeler - Model Tree

Select menu item **3D Modeler > Group by Material**

![Model Tree Diagram]

- **Model**
  - **My_Ring**
  - **My_Teflon**
  - **Not Assigned**
  - **pec**
    - **Conductor 1**
      - **CreateCylinder**
      - **SectionTo**
    - **Unite**
    - **CloneTo**
  - **vacuum**
- **Coordinate Systems**
  - **Global**
  - **RelativeCS1**
  - **RelativeCS2**
  - **RelativeCS3**
- **Planes**
  - **Points**
- **Lists**

**Grouped by Material**

- **Object**
  - **Conductor 1**
    - **CreateCylinder**
    - **SectionTo**
  - **Unite**
    - **CloneTo**
  - **CloneTo**
  - **Female**
  - **FemaleTeflon**
  - **MaleTeflon**
  - **Ring**
  - **p1**
  - **p2**
- **Coordinate Systems**
  - **Global**
  - **RelativeCS1**
  - **RelativeCS2**
  - **RelativeCS3**
- **Planes**
  - **Points**
  - **Lists**

**Object View**
Overview

3D Modeler - Attributes

- Model
- Box1
- CreateBox
- Coordinate Systems
- Planes
- Points
- Lists
Overview

**3D Modeler - Commands**
- Parametric Technology
- Dynamic Edits - Change Dimensions
- Add Variables
  - Project Variables (Global) or Design Variables (Local)
  - Animate Geometry
  - Include Units - Default Unit is meters
- Supports mixed Units

![Add Variable to HFSSModel1](image)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>CreateBox</td>
</tr>
<tr>
<td>Coordinate System</td>
<td>Global</td>
</tr>
<tr>
<td>Position</td>
<td>-1.0, 1.6, 0 mm</td>
</tr>
<tr>
<td>XSize</td>
<td>2.6 mm</td>
</tr>
<tr>
<td>YSize</td>
<td>2.8 mm</td>
</tr>
<tr>
<td>ZSize</td>
<td>1 mm</td>
</tr>
</tbody>
</table>

![Command](image)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>CreateBox</td>
</tr>
<tr>
<td>Coordinate System</td>
<td>Global</td>
</tr>
<tr>
<td>Position</td>
<td>-1.0, 1.6, 0 mm</td>
</tr>
<tr>
<td>XSize</td>
<td>my_x</td>
</tr>
<tr>
<td>YSize</td>
<td>2.8 mm</td>
</tr>
<tr>
<td>ZSize</td>
<td>1 mm</td>
</tr>
</tbody>
</table>
Overview

3D Modeler - Primitives

2D Draw Objects

- The following 2D Draw objects are available:
  - Rectangle, Circle, Line, Point, Spline, Ellipse, Regular Polygon (v8.5 circle)

3D Draw Objects

- The following 3D Draw objects are available:
  - Box, Cylinder, Sphere, Torus, Helix, Bond Wire, Cone, Regular Polyhedron (v8.5 cylinder)
Overview

3D Modeler - True Surfaces

See User Guide Chapter 4.1

Adaptive Refinement

- Preserves Facets
- Default: 30°

Automatic Volume Correction

Initial Mesh

Adaptive Refinement (Does not preserve Facets)
Overview

- **3D Modeler - Boolean Operations/Transformations**
  - **3D Modeler > Boolean >**
    - **Unite** - combine multiple primitives
      - Unite disjoint objects (Separate Bodies to separate)
    - **Subtract** - remove part of a primitive from another
    - **Intersect** - keep only the parts of primitives that overlap
    - **Split** - break primitives into multiple parts along a plane (XY, YZ, XZ)

  ![Toolbar: Boolean]

- **3D Modeler > Surfaces > Move Faces** - Resize or Reposition an objects face along a normal or vector.
- **Edit > Arrange >**
  - **Move** - Translates the structure along a vector
  - **Rotate** - Rotates the shape around a coordinate axis by an angle
  - **Mirror** - Mirrors the shape around a specified plane
  - **Offset** - Performs a uniform scale in x, y, and z.

  ![Toolbar: Arrange]

- **Edit > Duplicate >**
  - **Along Lines** - Create multiple copies of an object along a vector
  - **Around Axis** - Create multiple copies of an object rotated by a fixed angle around the x, y, or z axis
  - **Mirror** - Mirrors the shape around a specified plane and creates a duplicate

  ![Toolbar: Duplicate]

- **Edit > Scale** - Allows non-uniform scaling in the x, y, or z direction
**Duplicate boundaries with geometry**

- Works with all boundaries and excitations
  1. Select the menu item **Tools > Options > HFSS Options**
  2. HFSS Options Window:
     1. Click the **General** tab
        - Use Wizards for data entry when creating new boundaries: ✔ **Checked**
        - Duplicate boundaries with geometry: ✔ **Checked**
     2. Click the **OK** button

Example:
- Assign an Excitation to the face of an object
- Duplicate the object around an axis three times
- The Excitation is automatically duplicated
3D Modeler - Selection

Selection Types
- Object (Default)
- Face
- Edge
- Vertex

Selection Modes
- All Objects
- All Visible Object
- By Name

Highlight Selection Dynamically - By default, moving the mouse pointer over an object will dynamically highlight the object for selection. To select the object simply click the left mouse button.

Multiple Object Selection - Hold the CTRL key down to graphically select multiple objects

Next Behind - To select an object located behind another object, select the front object, press the b key to get the next behind. Note: The mouse pointer must be located such that the next behind object is under the mouse pointer.

To Disable: Select the menu item Tools > Options > 3D Modeler Options
- From the Display Tab, uncheck Highlight selection dynamically
3D Modeler - Moving Around

**Overview**

**Step 1:** Start Point

**Step 2:** Hold X key and select vertex point

**Step 3:** CTRL+Enter Keys set a local reference

**Step 4:** Hold Z key and set height

**Toolbar:** Snap Mode

**Snap Mode**

- Snap To:
  - Grid
  - Vertex
  - Edge Center
  - Face Center
  - Quadrant
  - Arc Center

**OK**

**Cancel**
Overview

**3D Modeler - Views**

- **View > Modify Attributes >**
  - **Orientation** - Predefined/Custom View Angles
  - **Lighting** - Control angle, intensity, and color of light
  - **Projection** - Control camera and perspective
  - **Background Color** - Control color of 3D Modeler background

- **View > Visibility** - Controls the display of: 3D Modeler Objects, Color Keys, Boundaries, Excitations, Field Plots

- **View > Options** - Stereo Mode, Drag Optimization, Color Key Defaults

- **View > Render > Wire Frame** or **Smooth Shaded** (Default)

- **View > Coordinate System > Hide** or **Small (Large)**

- **View > Grid Setting** - Controls the grid display

  Toolbar: Toggle Grid Visibility
Changing the View

**Toolbar**

Pan

Rotate

Zoom In/Out

Dynamic Zoom

**Context Menu**

- Rotate: Alt + Drag
- Pan: Shift + Drag
- Zoom: Alt + Shift + Drag
- Zoom In
- Zoom Out
- Fit All: Ctrl + D
- Fit Selection
- Spin
- Animate...

**Predefined View Angles**

- Top
- Left
- Bottom
- Right

**Shortcuts**

Since changing the view is a frequently used operation, some useful shortcut keys exist. Press the appropriate keys and drag the mouse with the left button pressed:

- **ALT + Drag** - Rotate
  - In addition, there are 9 pre-defined view angles that can be selected by holding the ALT key and double clicking on the locations shown on the next page.

- **Shift + Drag** - Pan
- **ALT + Shift + Drag** - Dynamic Zoom
Overview

3D Modeler - Coordinate System

- Can be Parameterized
- Working Coordinate System
  - Currently selected CS. This can be a local or global CS
- Global CS
  - The default fixed coordinate system
- Relative CS
  - User defined local coordinate system.
    - Offset
    - Rotated
    - Both
- Face CS (setting available to automatically switch to face coordinate system in the 3D Modeler Options)

Step 1: Select Face
Step 2: Select Origin
Step 3: Set X-Axis

Cone created with Face CS
Change Box Size and Cone is automatically positioned with the top face of the box
**Overview**

**HFSS - Solution Setup**

- *HFSS > Analysis Setup > Add Solution Setup*
- Picking the Adapt Frequency
  - See **User Guide Chapter 2**

**Add Solution Setup**

![Add Solution Setup](image1)

**Solution Setup**

- **Initial Mesh Options**
  - Do Lambda Refinement
  - Target: 0.3333
  - Use free space lambda

- **Adaptive Options**
  - Refinement Per Pass: 20
  - Minimum Number of Passes:
  - Minimum Converged Passes:

- **Use Low-Order Solution Basis**

- **ZERO_ORDER**
Ansoft High Frequency Structure Simulator v 9.0 –– Training Seminar

**Overview**

- **HFSS - Frequency Sweep**
  - **HFSS > Analysis Setup > Add Sweep**

![HFSS - Frequency Sweep Diagram]

- **Discrete** - Solves using adaptive mesh at every frequency
  - Matrix Data and Fields at every frequency in sweep
- **Fast** - ALPS
  - Matrix Data and Fields at every frequency in sweep
- **Interpolating** - Adaptively determines discrete solve points using the adaptive mesh
  - Matrix Data at every frequency in sweeps
  - Fields at last adaptive solution
Overview

Boundary Display

To verify the boundary setup:
1. Select the menu item **HFSS > Boundary Display (Solver View)**
2. From the Solver View of Boundaries, toggle the Visibility check box for the boundaries you wish to display.
   - **Note:** The background (Perfect Conductor) is displayed as the outer boundary.
   - **Note:** The Perfect Conductors are displayed as the smetal boundary.
3. Click the Close button when you are finished

Analyze

Model Validation

To validate the model:
1. Select the menu item **HFSS > Validation Check**
2. Click the Close button
   - **Note:** To view any errors or warning messages, use the Message Manager.

Analyze

To start the solution process:
1. Select the menu item **HFSS > Analyze**
Overview

What Information does HFSS Compute?

Matrix Data
- Modal/Terminal/Differential
  - S-, Y-, and Z-Parameters
  - VSWR
- Excitations
  - Complex Propagation Constant (Gamma)
  - Zo
- Full-Wave Spice
  - Full-Wave Spice - Broadband Model
  - Lumped RLC - Low Frequency Model
  - Partial Fraction - Matlab
  - Export Formats - HSPICE, PSPICE, Cadence Spectre, and Maxwell SPICE

Common Display Formats:
- Rectangular, Polar
- Smith Chart
- Data Tables

Common Output Formats:
- Neutral Models Files (NMF) (Optimetrics only)
  - Parametric Results
  - Touchstone, Data Tables, Matlab, Citi
  - Graphics - Windows Clipboard
**Overview**

**HFSS - Matrix Data**

1. **HFSS > Results > Solution Data**
2. Export
   - NMF, Touchstone, Data Tables, etc
   - **NOTE**: Make sure the **Simulation** is set to a **Sweep** before exporting. The Adaptive Passes will only export a single frequency point.
3. Equivalent Circuit Export
   - HSPICE, PSPICE, Cadence Spectre, Maxwell SPICE
Results - Data Management

**HFSS > Results > Browse Solutions**
- Solved model variations are retained. Unless otherwise notified by HFSS.

**HFSS > Results > Clean Up Solutions**

- Data Deletion Options:
  - Fields Only
  - Fields and Meshes
  - All Solution Data
- Variation Selection Options:
  - Non Current Variable Combinations
  - All Variations

NOTE: Deletions will occur immediately and cannot be recovered.

**HFSS > Results > Import Solutions**

- Import Solution:
  - Import Solution
  - Import Table
  - Delete Selections
Results - Create Reports

- **HFSS > Results > Create Report**
- Output Variables
  - User Defined Equations

**Create Report**

- Target Design: HFSSModel1
- Report Type: Terminal S Parameters
- Display Type: Rectangular Plot

**Traces**

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Y-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freq</td>
<td>dB(Stp1.Diff1:p1.Diff1)</td>
<td>Y1</td>
</tr>
<tr>
<td>Freq</td>
<td>dB(Stp1.Diff1:p1.Comm1)</td>
<td>Y1</td>
</tr>
<tr>
<td>Freq</td>
<td>dB(Stp1.Diff1:p2.Diff1)</td>
<td>Y1</td>
</tr>
</tbody>
</table>

**Context**

- Design: HFSSModel1
- Solution: Setup1: Sweep1
- Domain: Sweep

**Output Variables**

- Voltage Transform
- Terminal Port Z0
- Power
- VSWR
- Terminal 2 Parameter
- Terminal Y Parameter
- Terminal Z Parameter
- Voltage Transform
- Terminal Port Z0
- Freq

**Sweeps**

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
</tr>
</thead>
</table>

**Quantity**

- User Defined Equations

**Function**

- ang_rad
- dB
- lin
- rea
Overview

What Information does HFSS Compute?

Fields
- Modal/Terminal/Differential
  - Electric Field
  - Magnetic Field
  - Current (Volume/Surface)
  - Power
  - Specific Absorption Rate

Radiation
- 2D/3D Far-/Near-Fields
- Arrays
- RCS

Field Calculator
- User Defined Field Calculations

Common Display Formats
- Volume
- Surface
- Vector
- 2D Reports - Rectangular, Polar, Radiation Patterns

Common Output Formats:
- Animations - AVI, GIF
- Data Tables
- Graphics - Windows Clipboard, BMP, GIF, JPG, TIFF, VRML
Fields

- Select Object Volume, Surface, or Line to display fields
- **HFSS > Fields > Plot Fields**
- Modify Plot - Solution/Frequency/Qty
- Plot Attributes
- Edit Sources - Change Excitation
Mesh Display

Field Overlay

1. Select an object
2. Select the menu item **HFSS > Fields > Plot Mesh**
Menu Structure
- **Draw** - Primitives
- **3D Modeler** - Settings and Boolean Operations
- **Edit** - Arrange, Duplicate
- **HFSS** - Boundaries, Excitations, Mesh Operations, Analysis Setup, Results

---

**3D Modeler**
- Movements
  - Movement Mode
  - Grid Plane
  - Snap Mode
  - New Object Type
- Assign Material
- Coordinate System
  - List
- Surface
- Boolean
- Units
- Measure
- Generate History
- Delete Last Operation

---

**HFSS**
- Boundaries
- Excitations
- Mesh Operations
- Analysis Setup
- Optimetrics Analysis

---

**Edit**
- Undo
- Redo
- Cut
- Copy
- Paste
- Delete
- Ctrl+Z
- Ctrl+Y
- Ctrl+C
- Ctrl+V
- Del
- Arrange
- Duplicate
- Scale
- Properties

---

**View**
- Project
- Draw
- 3D Mi
- HFSS
- Tools
- Window
- Help

---

**Project Manager**
- Project...
Overview

Measure

- **3D Modeler > Measure >**
  - **Position** - Points and Distance
  - **Length** - Edge Length
  - **Area** - Surface Area
  - **Volume** - Object Volume

---

**Measure Information**

<table>
<thead>
<tr>
<th>Entity</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertex_351</td>
<td>Position(Vertex_351) = [100, -100, -13] mil</td>
</tr>
<tr>
<td>Vertex_354</td>
<td>Position(Vertex_354) = [100, -100, 13] mil</td>
</tr>
<tr>
<td></td>
<td>Distance = 26 mil</td>
</tr>
</tbody>
</table>

---

Position Points
Overview

Options - General
- **Tools > Options > General**
  - **Temp Directory** - Location used during solution process
    - Make sure it is at least 512MB free disk.
    - If you get out of disk errors, check this

Options - HFSS
- **Tools > Options > HFSS**
  - Number of Processors - Requires additional license
  - Memory Limit Soft - Set to 80% of Physical RAM
Overview

Converting Older HFSS Projects to HFSS v9

From HFSS v9.0,
1. Select the menu item **File > Open**
2. Open dialog
   1. Files of Type: **Ansoft Legacy EM Projects (.cls)**
   2. Browse to the existing project and select the .cls file
   3. Click the **Open** button

What is Converted?
- Converts Entire Model: Geometry/Materials/Boundary/Sources/Setup
- **Solutions, Optimetrics projects and Macros are not converted**

Legacy License
- Existing customers using HFSS v8.5 should have received legacy licenses with the new v9.0 licenses.
- These licenses allow you to run either v9.0 or v8.5.
- Easy transition from v8.5 to v9.0
- Contact your Account Manager if this feature is not available.

Recommended Service Packs (SP)
- Microsoft Windows XP - SP1 or higher
- Microsoft Windows 2000 - SP3 or higher
- Microsoft Windows NT - SP6a
Overview

- Project Files
  - Everything regarding the project is stored in an ascii file
  - File: `<project_name>.hfss`
  - Double click from Windows Explorer will open and launch HFSS v9
  - Results/Mesh are stored in a folder named `<project_name>.hfssresults`
  - Lock file: `<project_name>.lock.hfss`
  - Created when a project is opened
  - Auto Save File: `<project_name>.hfss.auto`
    - When recovering, software only checks date.
    - If error occurred when saving the auto file, the date will be newer than the original.
    - Look at file size (Provided in recover dialog)

- Scripts
  - Default Script recorded in v9
  - Visual Basic Script
  - Supported Scripting Languages (Windows)
    - Anything that is COM capable
    - JavaScript, Matlab, Excel, Visual Basic, C/C++

- Remote Solves
  - *Tools > Options > General*
  - Uses DCOM

![HFSS Server Setup](image)
Overview

Ansoft Designer SV

- Ansoft Designer™ SV is a full-featured subset of Ansoft's commercially distributed Ansoft Designer.
- Ansoft Designer SV contains a complete high-frequency linear circuit simulator, schematic and layout design entry, powerful design utilities, and post-processing, all integrated in an easy-to-use environment. The software also includes a complete set of linear distributed transmission line models, discontinuities, vendor component parts, and ideal circuit elements.
- Ansoft Designer SV allows the simulation of S-, Y-, and Z-parameters, group delay, noise figure, and stability circles of RF and microwave circuits. Utilities include real-time tuning, filter and TRL synthesis, and Smith Tool matching. Post-processing includes rectangular plots, Smith Charts, polar plots, and data tables. Additionally, Ansoft Designer SV comes with a set of real-world examples.
- **Free Download**: www.ansoft.com/ansoftdesignersv
For Technical Support

- The following link will direct you to the Ansoft Support Page. The Ansoft Support Pages provide additional documentation, training, and application notes. Web Site: http://www.ansoft.com/support.cfm
- Technical Support:
  - 9-4 EST: (412) 261-3200 x0 - Ask for Technical Support

Application Engineers for North America

- The names and numbers in this list may change without notice

  - **Ansoft Office: Pittsburgh, PA, 412-261-3200**
    - Yianni Antoniadis, x175, yantoniadis@ansoft.com
    - Shu Li, x172, sli@ansoft.com
  - **Ansoft Office: Boston, MA, 781-229-8900**
    - Jim Delap, x133, jdelap@ansoft.com
  - **Ansoft Office: Boulder, CO, 303-541-9525**
    - Bryan Boots, x31, bboots@ansoft.com
    - Brian Gray, x32, bgray@ansoft.com
  - **Ansoft Office: El Segundo, CA, 310-426-2287**
    - Aaron Edwards, aedwards@ansoft.com
    - Liza Ma, lma@ansoft.com
    - Peter Shin, pshin@ansoft.com
  - **Ansoft Office: Santa Clara, CA, 408-261-9095**
    - Harpreet Randhawa, x210, hrandhawa@ansoft.com
    - Denis Soldo, x214, dsoldo@ansoft.com
  - **Others**
    - Matt Commens, IL, 847-925-9066, mcommens@ansoft.com
    - Lisa Murphy, AZ, 408-288-1114, lmurphy@ansoft.com
    - Jim Sherman, FL, 727-394-1023, jsherman@ansoft.com
  - **Canada**
    - Markus Kopp, Ottawa, 613-241-0500, mkopp@ansoft.com