



YOUR FASTEST SOLUTION TO A BETTER DESIGN



ElecNet

Version 7.8
Or later

Getting Started Guide

May 30, 2017

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email: docs@infolytica.com

fax: Documentation Department
(514) 849-4239

post: Documentation Department
Infolytica Corporation
300 Leo Pariseau, Suite 2222
Montreal, Quebec H2X 4B3
Canada

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ElecNet
Getting Started Guide

Chapter 1 – Welcome to ElecNet

Welcome

ElecNet provides state-of-the art visualization to help you easily build 2D and 3D models for electrostatic, DC current flow, time-harmonic, and transient analysis. Infolytica's leading edge technologies transparently generate the finite element mesh and quickly provide accurate field solutions.

The structures which can be simulated with ElecNet include:

- Power transformers
- Biomedical applications
- Implants
- Electrical insulators
- Connectors
- Micro-motors
- Micro-actuators

Learning ElecNet

Your ElecNet documentation package consist of this Getting Started Guide and Tutorials in an electronic media format (i.e. PDF files), and also includes a comprehensive HTML Help (ElecNet.chm) system.

Getting Started Guide	Tutorials
<ul style="list-style-type: none">• Installation instructions• Introduction to modeling	<ul style="list-style-type: none">• 2D Electrostatic Tutorial: Spheres• 2D Current Flow Tutorial: Conductance of a trimmed resistor• 2D Time-harmonic and Transient Tutorial: Microstrip• 3D Electrostatic and Transient Tutorial: Microstrip

Additional help is available by visiting the Support section of our website:

- Live Docs -- an integrated and centralized source of up-to-date documentation

Additional information

More information on the procedures and concepts of model building with ElecNet is found in the Help included with each package.

Note The ElecNet Help menu provides easy access to the PDF versions of this Getting Started Guide and the Tutorials.

ElecNet
Getting Started Guide

Chapter 2 – Installation Instructions

Overview

This chapter contains instructions for:

- Installing ElecNet
- Obtaining a license key file for ElecNet
- Installing a ElecNet node-locked license
- Installing the License key server
- Installing a floating (network) license key file for ElecNet
- Connecting a node to the license key server
- Where to contact Customer Support

For system requirements, please refer to:

- <http://www.infolytica.com/en/products/elecnet/requirements.aspx>

Note that ElecNet requires Microsoft® Visual Basic®, Scripting Edition (VBScript) to run. The ElecNet setup program will install VBScript on your computer.

Installing ElecNet from a CD

The procedure is identical, whether you are installing ElecNet as a new system or as an update.

1. Insert the ElecNet CD into the drive.
2. From the Windows START menu, select *Run*.
If *Run* command line is not listed, press keys *Windows Logo + R* to open the *Run* dialog.
3. In the *Open* text box of the *Run* dialog, type the following:

D:\setup.exe

(where D is the name of the CD drive).

The ElecNet Setup program is initiated.

4. Follow the instructions given by the Setup program.

Note Copies of ElecNet are shipped without a license key file. You will need to run the Client ID program to obtain a license key file. Please see “Obtaining a license key file for ElecNet” on page 4.

Note If the Microsoft Scripting Setup program prompts you to re-boot the computer after installing VBScript and JScript, or after installing DCOM, do not re-boot at that time. Please wait until the ElecNet Setup program prompts you to re-boot.

Obtaining a license key file for ElecNet

A license key file can be node-locked (single-user) or floating (network-based). To obtain a license key file, you must run the Client ID program. The Client ID program displays information about your computer that you must send to Infolytica Customer Support. The client information provided by the Client ID program will be used by Infolytica Corporation in the preparation of a license key file.

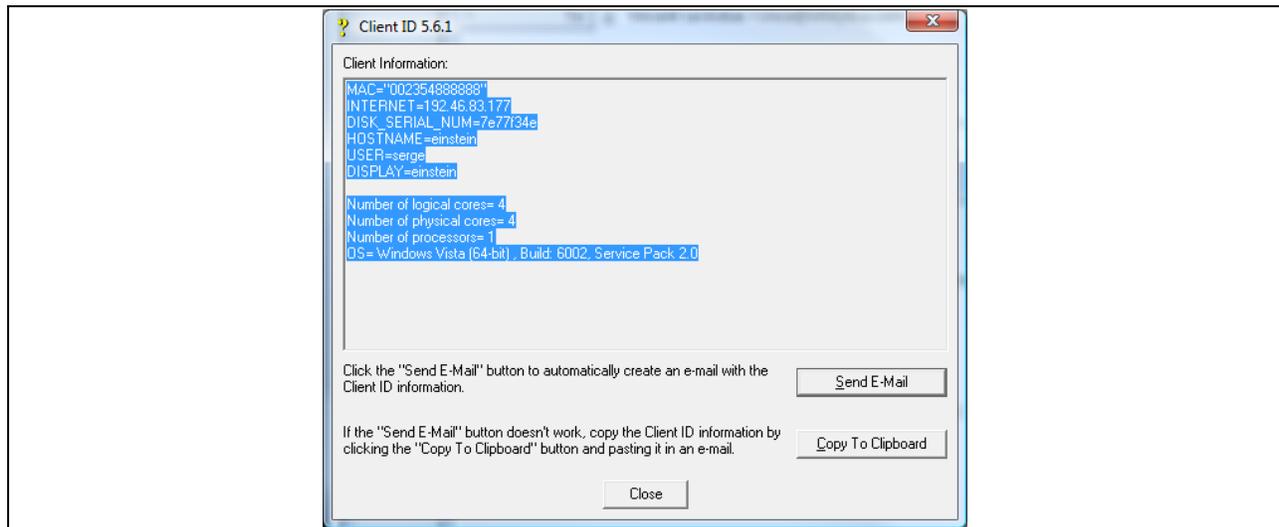
The Client ID program can be run from the Windows' Start menu created by the Setup program.

- For instructions on installing a node-locked license, please see “Installing a ElecNet node-locked license” on page 5.
- For instructions on installing a floating license, please see “Installing a floating (network) license key file for ElecNet” on page 6.

To obtain a license key file

1. From the Windows' Start menu, navigate to *All Programs/Infolytica/ElecNet <version number> Docs & Tools*, and then click "Client ID".

The Client ID dialog appears.



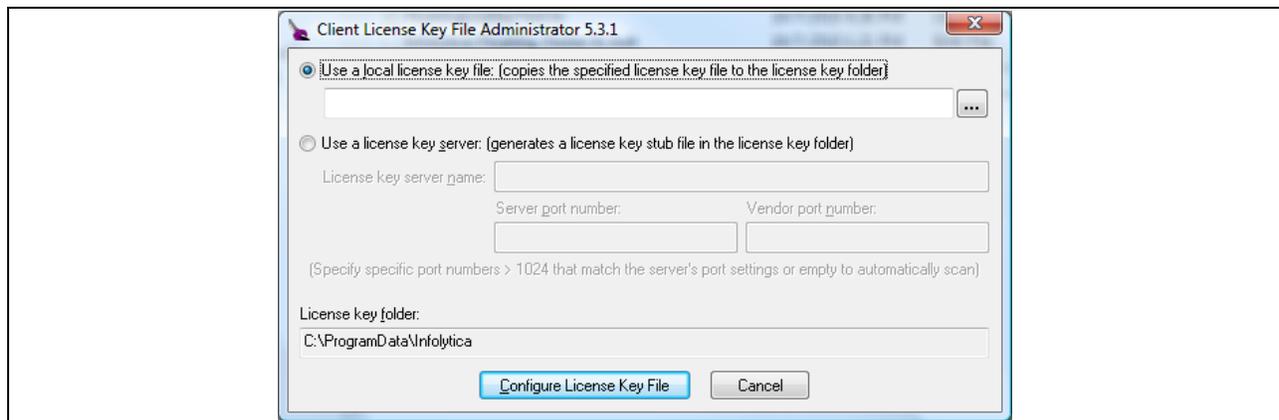
2. In the Client ID dialog, do one of the following:
 - **Click “Send E-Mail”** -- This action opens your default e-mail account and automatically places the contents of “Client Information” into the body of the e-mail message.
 - **Click “Copy To Clipboard”** – This action requires that you open your e-mail account and paste (press CTRL+V) the contents of the “Clipboard” into the body of the e-mail message.
3. **Important** -- Add the following information to the e-mail message:
 - Your name
 - Your affiliation (e.g., company name)
 - The version of ElecNet you have installed (e.g. ElecNet 7.1.2)
4. Send the e-mail to your Customer Support representative. (please see “Where to contact Customer Support” on page 9 for the appropriate e-mail address -- for example, if you reside in Canada or the United States, you would send the e-mail to *support@infolytica.com*).

Installing a ElecNet node-locked license

Note This procedure assumes that you have obtained a license key file (ElecNet.lic) from your Customer Support representative and placed it in a temporary folder (e.g., C:\Temp). If you still haven't requested a license key file, please see "Obtaining a license key file for ElecNet" on the previous page.

1. From the Windows' Start menu, navigate to *All Programs/Infolytica/ElecNet <version number> Docs & Tools*, and then click "Client License Key File Administrator".

The *Client LicenseKey File Administrator* dialog appears.



2. Select the option "Use a local license key file".
3. In the License key file text box, type the path (e.g., C:\Temp\ElecNet.lic), or browse to the location of the license key file that you have received from your Customer Support representative.
4. Click the *Configure License key file* button.
5. At the "Backup and Replace File?" prompt, click *Yes*.
The new license key file is installed.

Installing the License key server

This procedure installs the Infolytica License key server on the computer designated as the server in a network environment.

1. Insert the ElecNet CD into the drive.
2. From the Windows Start menu, select *Run*.
3. In the *Open* text box of the *Run* dialog, type the following:

D:\LicenseServer\setup.exe
(where D is the name of the CD drive).

The License key server Setup program is initiated.

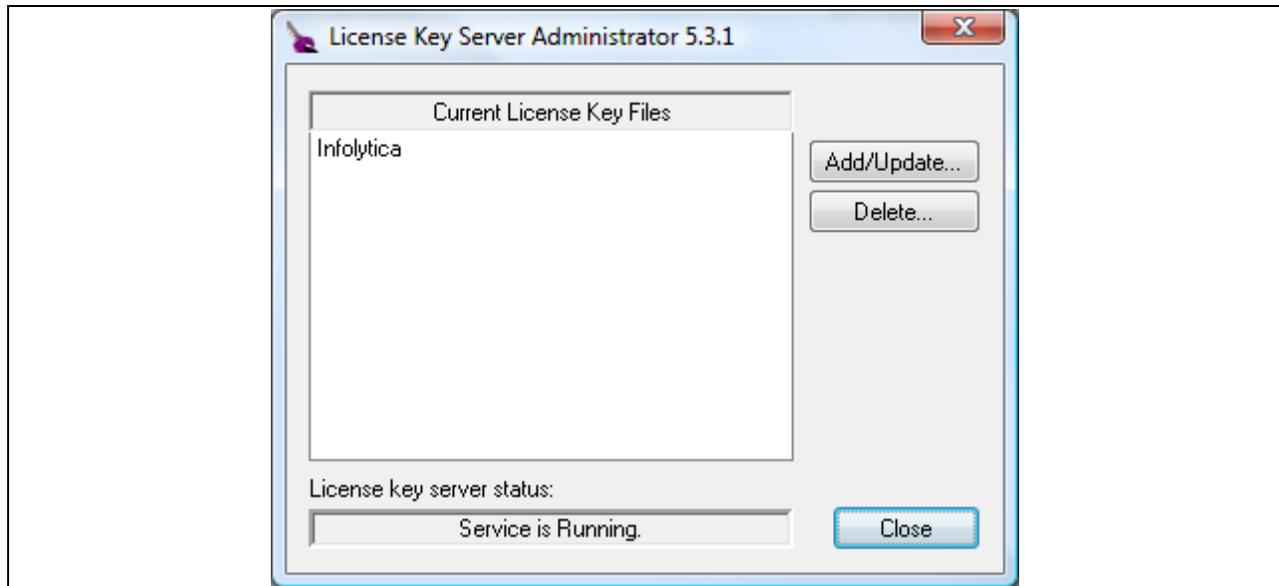
4. Follow the instructions given by the Setup program.

Note Once the setup is complete, you will need to run the Client ID program on the server to obtain a floating license key file. Please see "Obtaining a license key file for ElecNet" on the previous page.

Installing a floating (network) license key file for ElecNet

The following instructions describe how to install a floating (network) license key file on a license key server.

Note This procedure assumes that you have obtained a floating license key file (ElecNet.lic) from your Customer Support representative and placed it in a temporary folder (e.g., C:\Temp). If you still haven't requested a license key file, please see "Obtaining a license key file for ElecNet" on page 4.



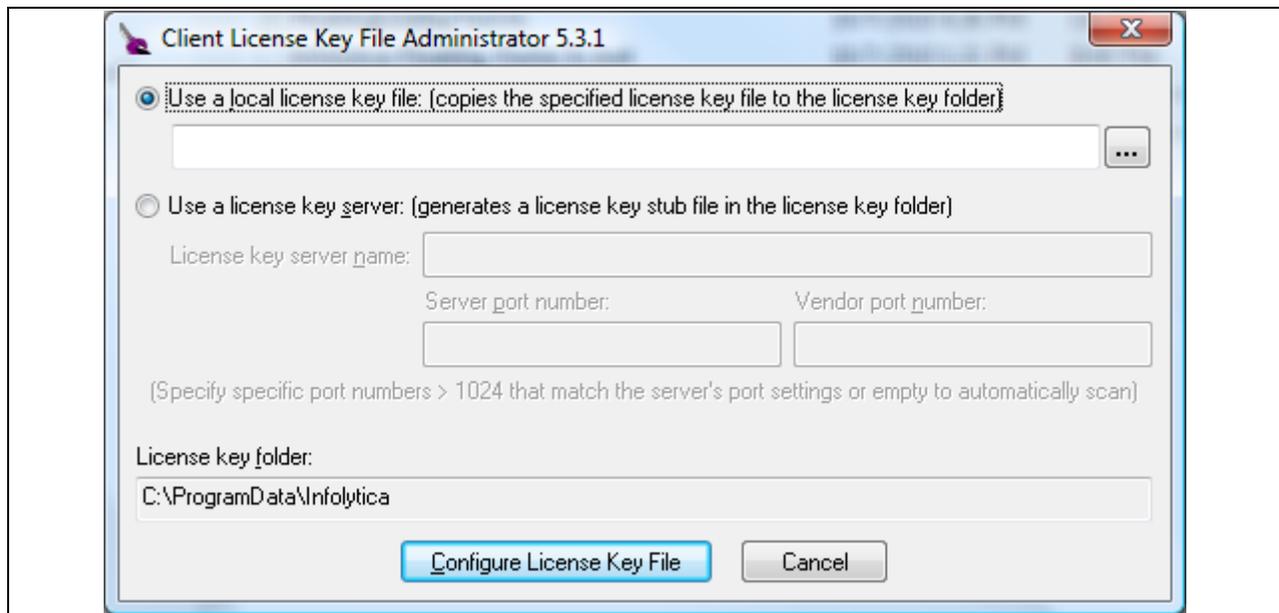
1. From the Windows' Start menu, navigate to *All Programs/Infolytica*, and then click "Infolytica License key server Administrator <version number>".
The *License key server Administrator* window appears.
2. Click the Add/Update button.
3. From the *Open* dialog, locate the license key file (e.g., C:\Temp\ElecNet.lic), then click *Open*.
4. In the *License key server Administrator* window, click *Close*.
If the License key server is not already running and you are prompted to start it, click *Yes*.

Connecting a node to the license key server

Note This procedure assumes that you have obtained a license key file (ElecNet.lic) from your Customer Support representative and installed it on the license key server. Please see “Installing a floating (network) license key file for ElecNet” on page 6.

1. From the Windows’ Start menu, navigate to *All Programs/Infolytica/ElecNet <version number> Docs & Tools*, and then click "Client License Key File Administrator".

The *Client License Key File Administrator* dialog appears.



2. Select the option "Use a license key server".
 3. In the *License key server name* text box, type the name of the Server (e.g., Avatar).
 4. Click the *Configure License key file* button.
 5. At the "Backup and Replace File?" prompt, click *Yes*.
- The applications will now connect to the floating license key server the next time they are started.

Where to contact Customer Support

North America and International (outside of the areas that are listed below)

Infolytica Corporation

Telephone: + 1 514 849 8752 ext. 600
Fax: + 1 514 849 4239
E-mail: support@infolytica.com

Europe

Infolytica Limited, UK

Telephone: + 44 (0) 1327 810383
Fax: + 44 (0) 1327 552383
E-mail: support@infolytica.co.uk

Japan

Adtech Co. Ltd.

Telephone: + 81 3 5475 1540
Fax: + 81 3 5475 1541
E-mail: support2@ad-tech.co.jp

India

Tessolve Semiconductor Pvt. Ltd.

Telephone: + 91 80 4181 2626
Fax: + 91 80 4120 2626
E-mail: sundararajan@tessolve.com

China

Beijing Hi-key Technology Corp Ltd

Telephone: + 86 10 8231 8880
Fax: + 86 10 8232 4448
E-mail: guwg@hikeytech.com

Korea

VFK Inc.

Telephone: + 82 54 223 2431
Fax: + 82 54 223 2430
E-mail: koni@vfk.co.kr

Taiwan

Alpha Precision Instrumentation Corporation

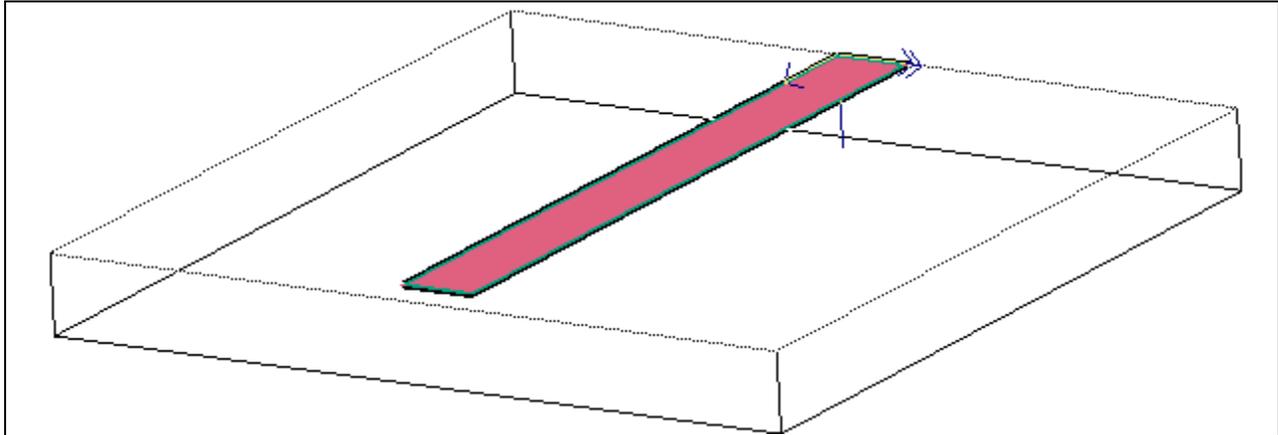
Telephone: + 886 02 2508 3066
Fax: + 886 02 2507 7185
E-mail: Lister@apic.com.tw

ElecNet
Getting Started Guide

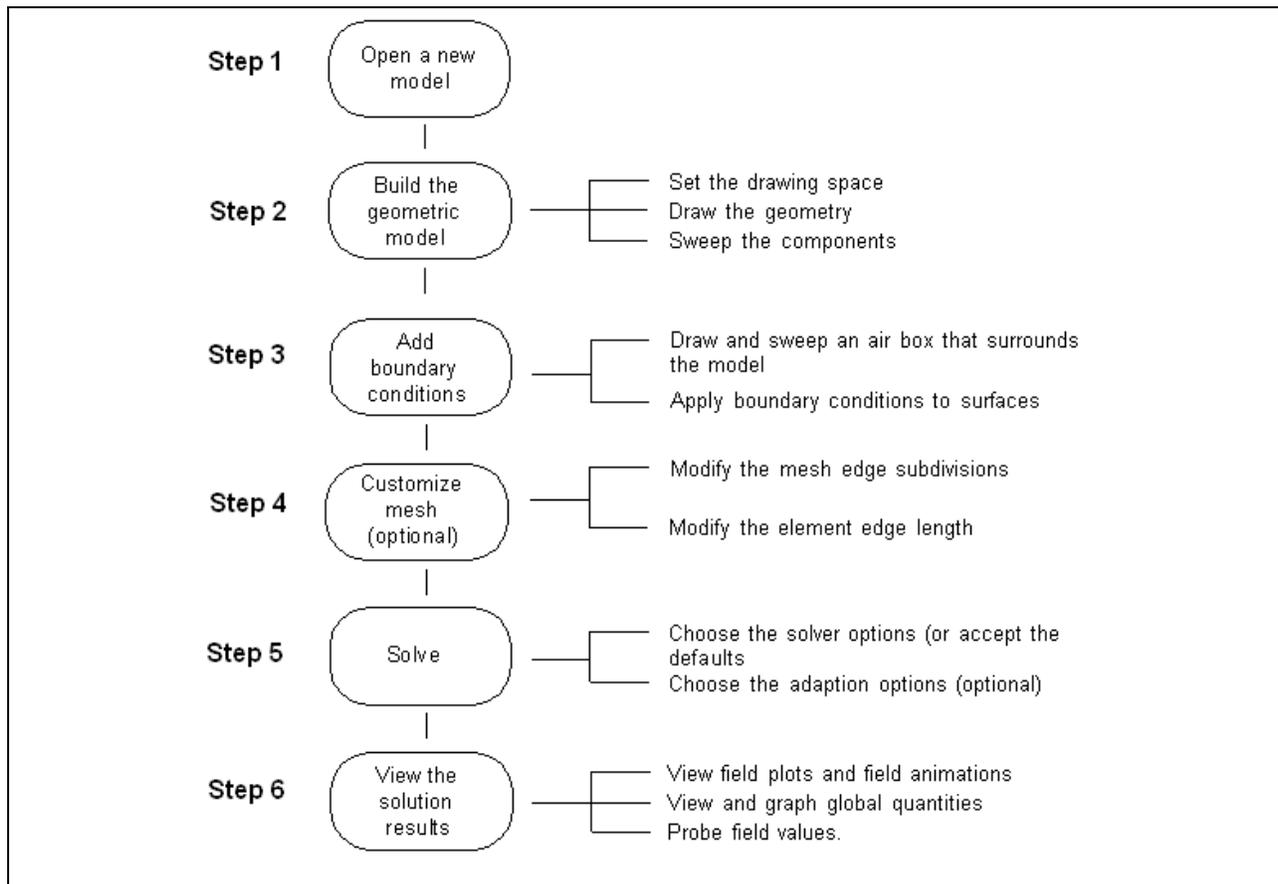
Chapter 3 – Model building with ElecNet

Introduction to model building

An ElecNet model is made from a geometric model to which materials, boundary conditions and excitations are assigned. After the model is solved, field plots and numerical results are available for viewing. The finite element mesh of the model can be customized to increase solution accuracy.



Modeling flowchart



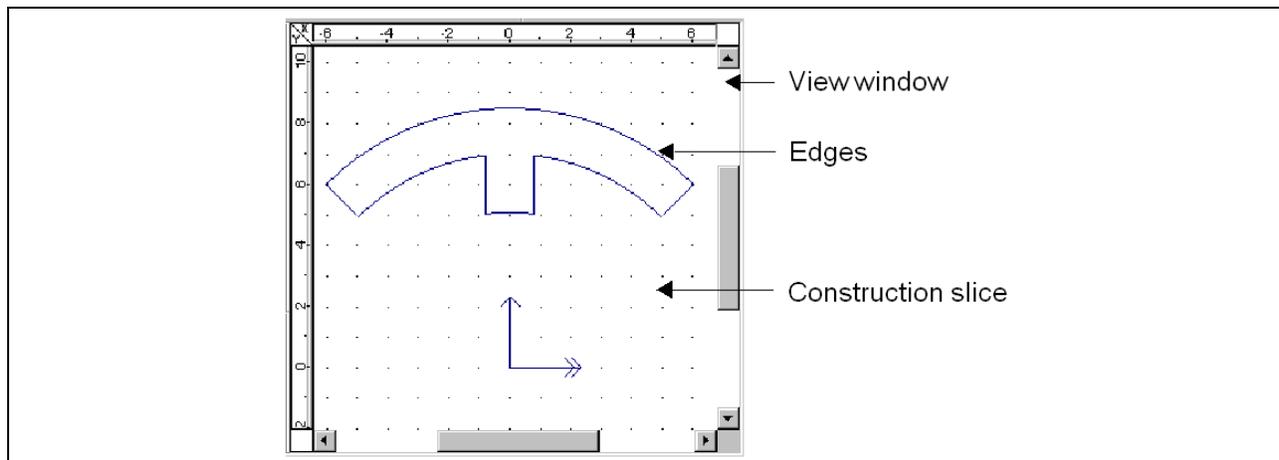
Geometric modeling

The geometric model is constructed from three basic building blocks:

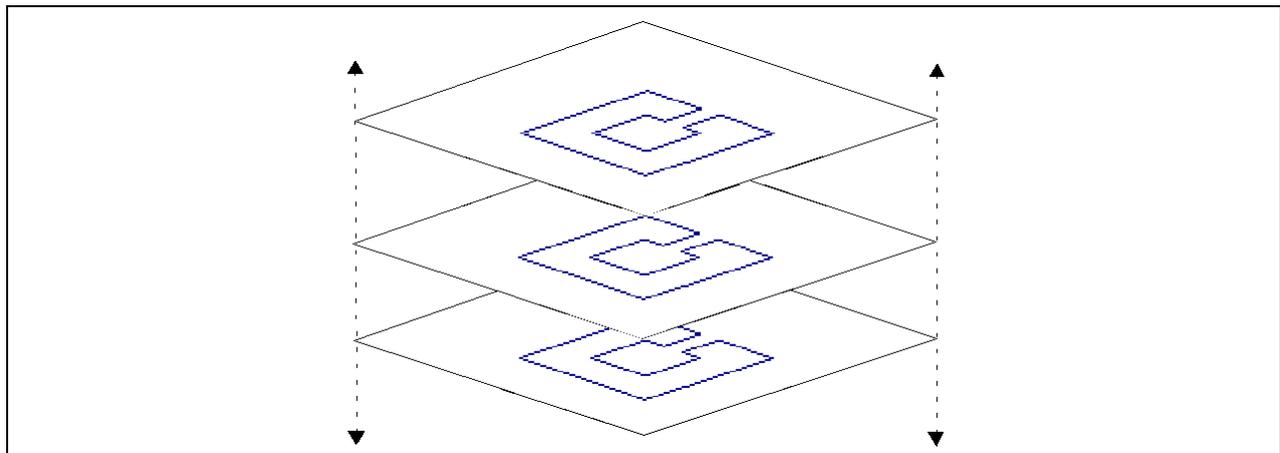
- Edges
- Surfaces
- Components

Edges

Edges are lines and arcs. They are drawn on the construction slice in the View window.

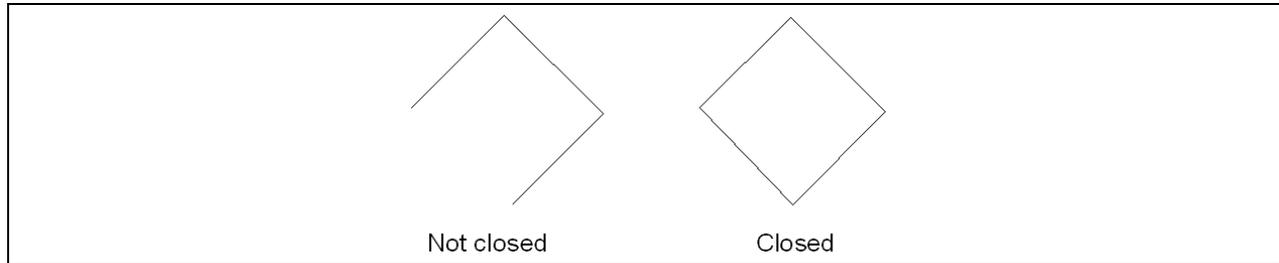


The construction slice is a two-dimensional editing plane that can be moved forward and backward in space. Edges drawn on the construction slice move with the slice and remain in view until they are intentionally removed by the user.



Surfaces

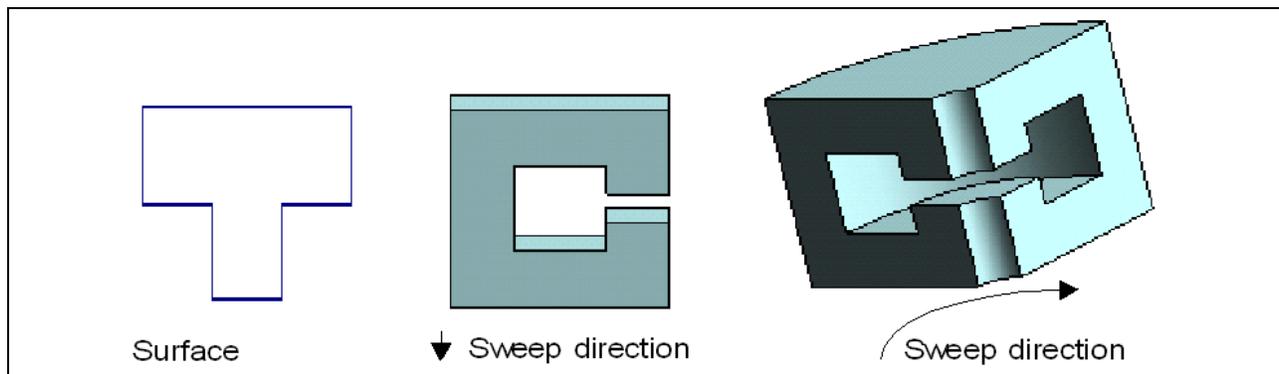
Edges are drawn to create surfaces. Surfaces are swept to create three-dimensional components. A surface must be “closed” before it can be swept to create a component.



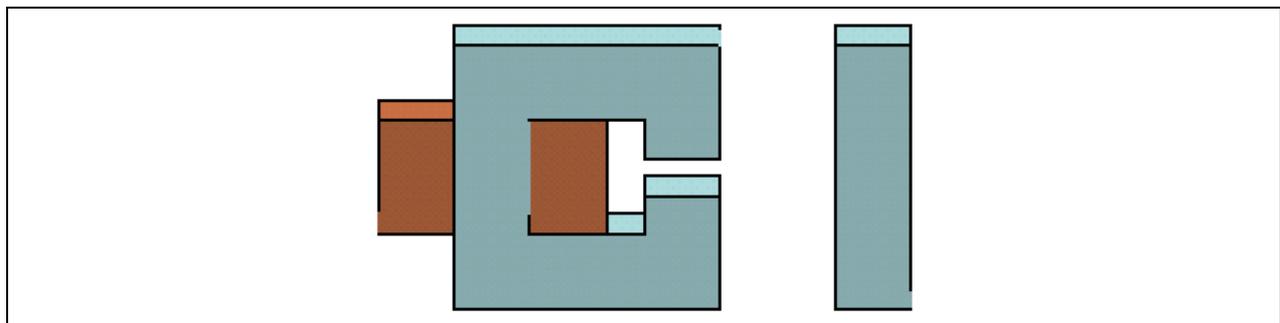
Components

Components can be swept in a positive or negative direction:

- For an arbitrary length
- In a circular arc through any angle

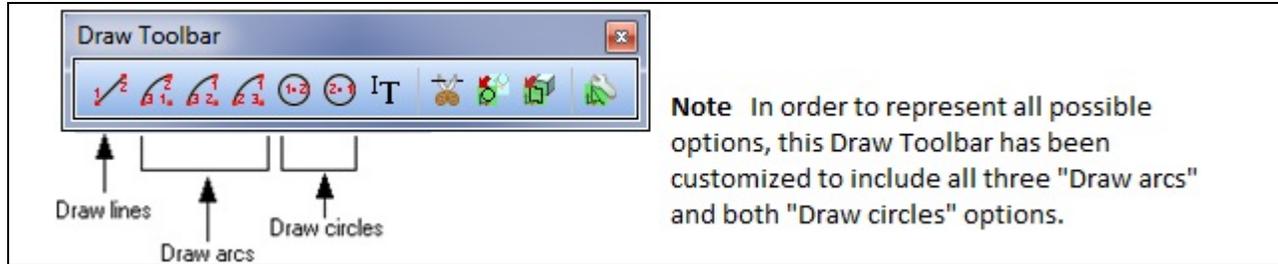


By drawing and sweeping surfaces, additional components are added to form an entire model.



Drawing edges

Edges are drawn using the Draw toolbar and either the mouse pointer or the Keyboard Input bar. You can draw lines, arcs, or circles.



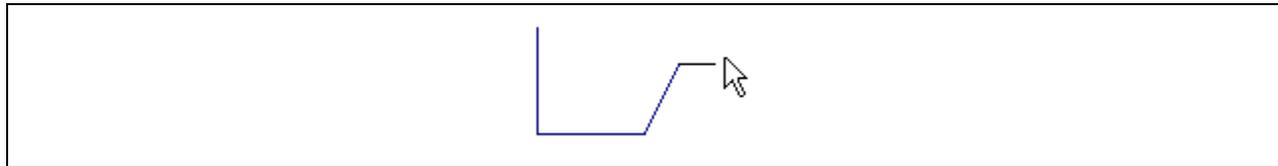
Edges are drawn on the construction slice.

Note Edges are saved with the model even if the user has not swept the geometry before closing.

Lines

Using the mouse pointer

Lines are drawn as polylines. That is, line drawing is continuous until you press ESC or double-click the mouse.



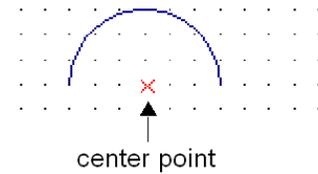
Using the Keyboard Input bar

Lines are entered as coordinate PAIRS. The last coordinate PAIR entered becomes the start coordinate PAIR of the next line. To stop drawing, or to begin a new line, press ESC on your keyboard.



Arcs

Note When drawing an arc using the mouse pointer or keyboard, ElecNet automatically adjusts the end point to have the same radius from the center point as does the start point.



Using the mouse pointer to draw an arc

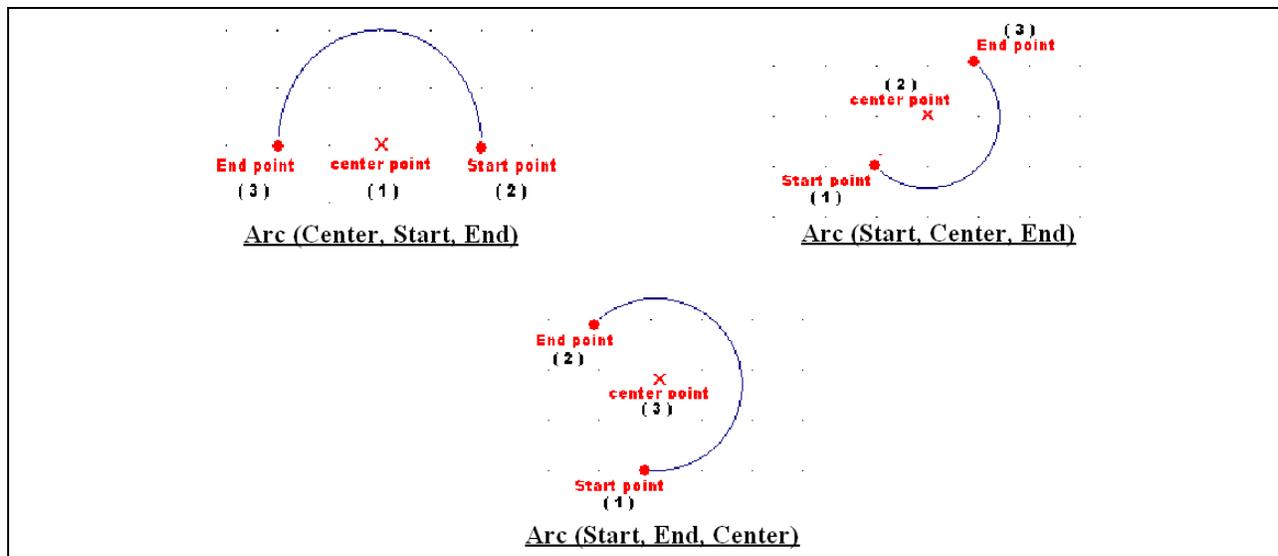
Three different methods exist, when using the mouse pointer, for drawing arcs in ElecNet.

- Arc (Center, Start, End) 
- Arc (Start, Center, End) 
- Arc (Start, End, Center) 

Note Arcs are drawn in a counter-clockwise direction.

Holding the Ctrl key down, while drawing the arc, inverts the direction of the arc. The arc is still created counter-clockwise; it is only the start and end points that are inverted.

A “rubber-band” line follows the movement of the mouse pointer.

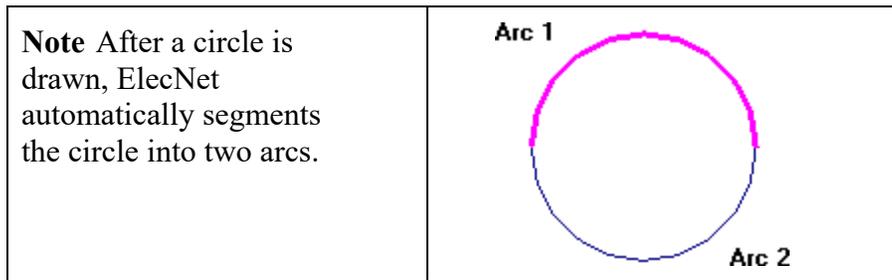


Using the Keyboard Input bar to draw an arc

Arcs are drawn by entering three coordinates, in the order that corresponds to one of the three chosen methods (see above for reference):

- Center point, Start point, End point
- Start point, Center point, End point
- Start point, End point, Center point

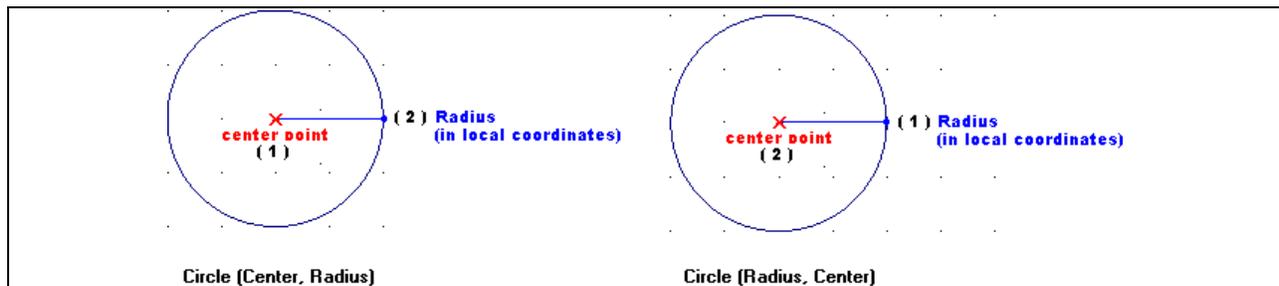
Circles



Using the mouse pointer to draw a circle

Two different methods exist, when using the mouse pointer, for drawing circles in ElecNet.

- Circle (Center, Radius) 
- Circle (Radius, Center) 



Note A “rubber-band” line follows the movement of the mouse pointer.

Using the Keyboard Input bar to draw a circle

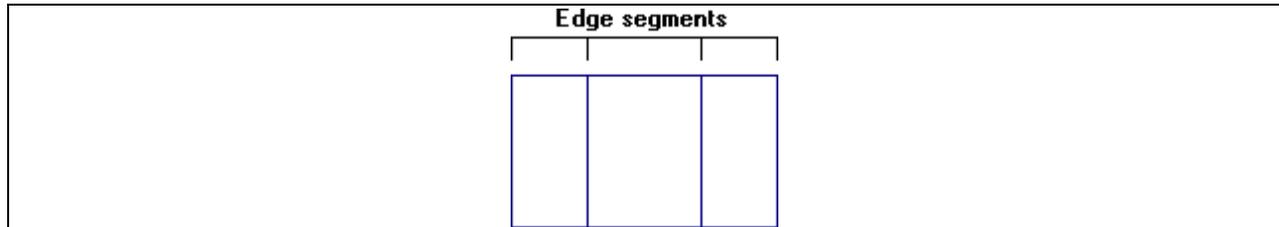
Circles are drawn by entering two coordinates, in the order that corresponds to one of the two chosen methods (see above for reference):

- Center point, Point on the radius of the circle
- Point on the radius of the circle, Center point



Segmenting edges

Edges are not automatically segmented at the point of intersection with other edges. Only when the user has selected the specific edges, and then clicked Segment Edges on the Model menu, do the lines segment.



Snap modes

The snap modes control the location of entry points made with the mouse pointer. There are seven snap modes: Grid, Endpoint, Intersection, Nearest, Center, Tangent, and Perpendicular.

None	Points appear exactly where the mouse pointer clicks in the display.
Grid	Snaps to the nearest grid point.
Endpoint	Snaps to the nearest endpoint of existing edges.
Intersection	Snaps to the nearest endpoint of existing edges or the intersection between existing edges.
Nearest	Snaps to the nearest point on existing edges – any point.
Center	Snaps to the nearest existing arc center.
Tangent	Snaps to the nearest point on Construction Slice, where edge being drawn becomes tangent.
Perpendicular	Snaps to the nearest point on Construction Slice, where edge being drawn becomes perpendicular.

Note *Tangent* and *Perpendicular* snap modes behave like *None* for the first point of an edge because a point alone cannot be tangent or perpendicular.

A line being drawn may also become tangent or perpendicular at its first point, if this point resides anywhere on an existing edge. Hence, using *Endpoint* for the first point, and *Tangent* or *Perpendicular* for the second point, allows prolonging an existing line or drawing a line perpendicular to it.

The snap mode stays in effect until a new snap mode is selected. Select *None* from the *Draw menu* to turn off the snap mode.

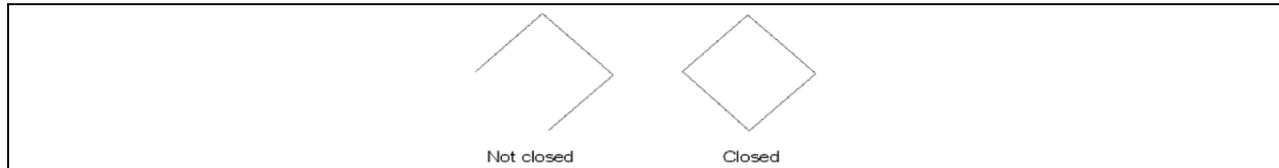
Creating surfaces

Surfaces are the basis of 3D components. Surfaces are 2D regions formed by:

- Edges drawn on the construction slice
- 2D faces of 3D components

Construction slice surfaces

Surfaces drawn on the construction slice must be “closed” before they can be selected.

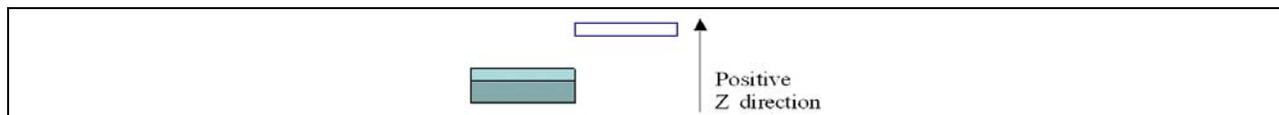


After a surface has been made into a component, the edges of the surface are duplicated in the component. The original edges remain on the construction slice.

Note To remove the construction slice edges, select all of the edges and then click *Delete* on the Edit menu.

Moving edges with the construction slice

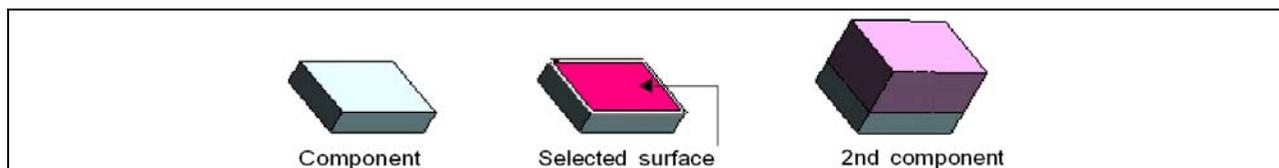
Edges can only exist on the construction slice. If the construction slice is repositioned, all edges move with the construction slice. For example, in the diagram below, the construction slice, with edges, has been moved 2 meters in the positive Z direction.



Note Edges on the construction slice are saved with the model.

Component surfaces

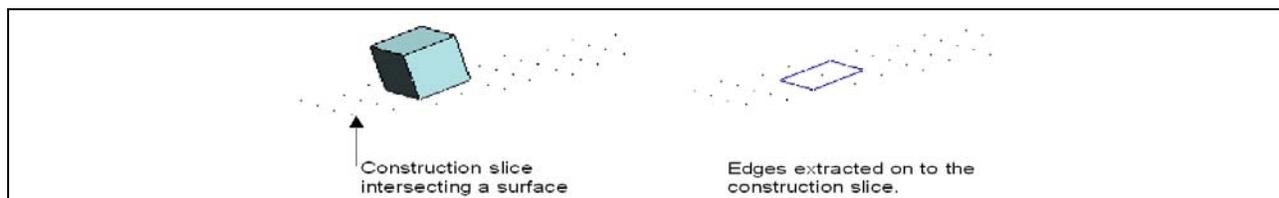
Components can also be created from the 2D surfaces of other components.



Extracting edges

After a surface has been made into a component, the edges of the surface are duplicated in the component. You can copy the edges of a component’s surface to the construction slice using the Extract Edges command.

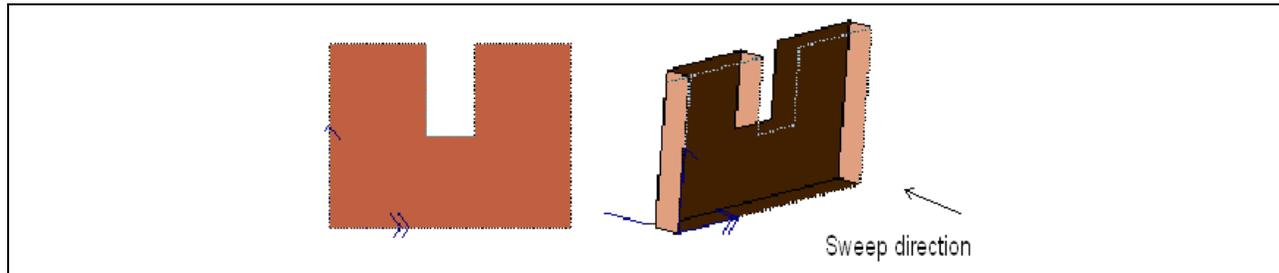
Note The construction slice must intersect the surface.



Creating components

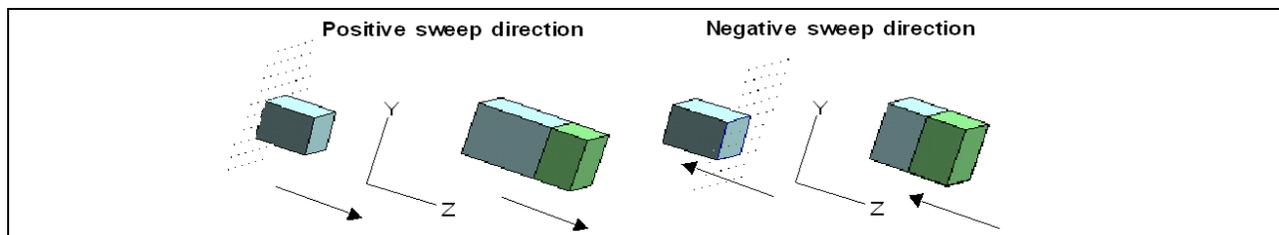
Components are created from surfaces (see “Creating surfaces” on page 8) or using the CSG Modeling technique (see page 11). Components can be swept in either a linear or rotational direction.

Note If you are using the Extrusion modeler, all the components of the model must be swept in the same linear or rotational direction.



Default sweep direction

The default sweep direction for a component is positive (sweeping out of the construction slice or out from the surface of a component).

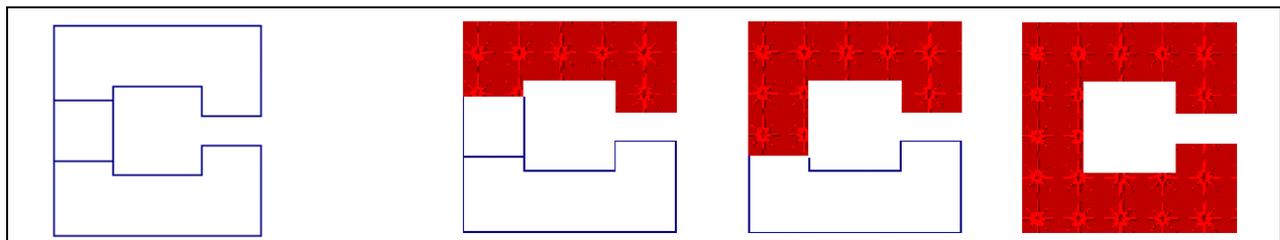


Creating multiple components simultaneously

More than one surface can be selected to create a component.

Note When multiple components are created simultaneously, all components share the same material and sweep distance. You can later change the properties of any component in the Component property and parameter pages.

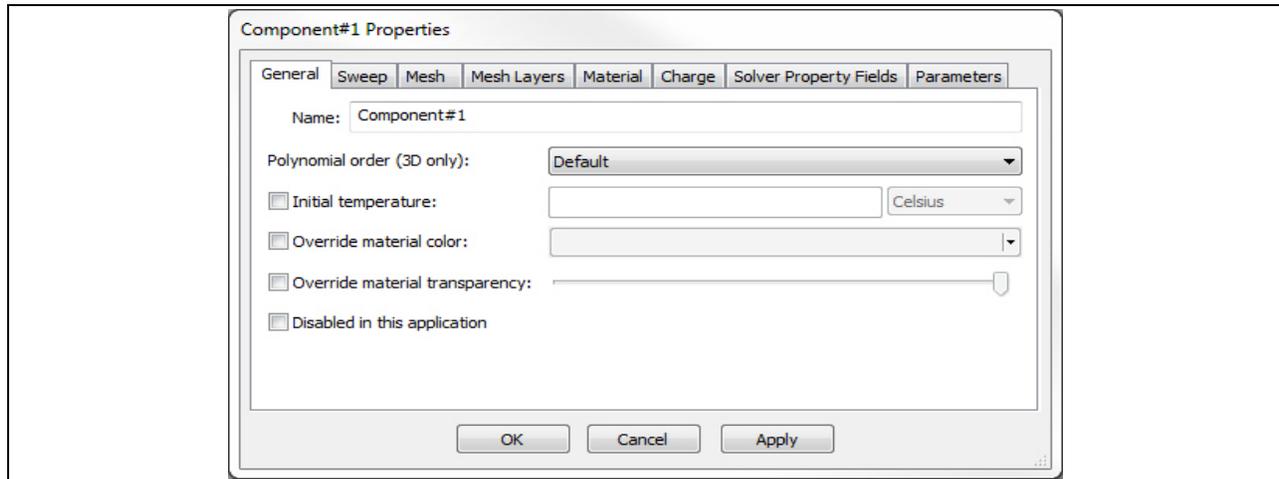
In the model below, three surfaces exist. You can sweep all of these surfaces at the same time. To select all three surfaces, hold down the SHIFT key while selecting each surface. After all the surfaces are selected, you can use the Make Component tool.



Tip When you press SHIFT or CTRL as you select objects, every object you click on remains selected. Pressing CTRL as you select objects also enables you to click on an object a second time to de-select the object.

Changing component properties

The properties of a component are changed in the Component Properties dialog, which consists of seven pages (General, Sweep, Mesh, Mesh Layers, Material, Charge, and Parameters).

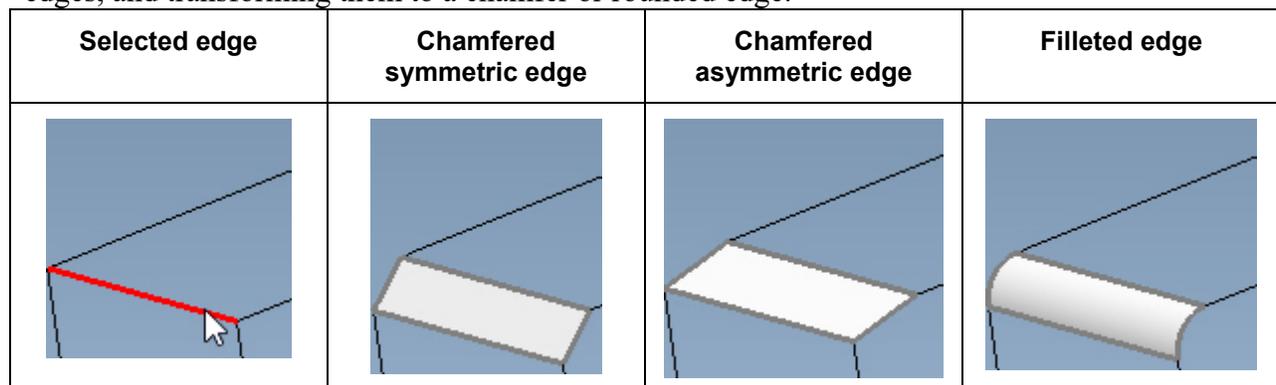


You can change the following properties:

- Name
- Polynomial order (3D models only)
- Initial Temperature
- Enable/Disable the component
- Line, arc, or multi-sweep settings
- Maximum element size
- Curvature Refinement minimum element size
- Curvature Refinement angle
- Mesh Layer type (Uniform, Logarithmic, User-defined)
- Material
- Material direction
- Charge density for the volume (in Coulomb/length³)
- Parameters for:
 - Charge density for the volume (in Coulomb/length³)
 - Material
 - Material direction
 - Position of the starting surface of the component
 - Sweep distance
 - Maximum element size
 - Polynomial order (3D models only)
 - Geometric position
 - Angle of the start and end surfaces (3D models only)
 - etc.

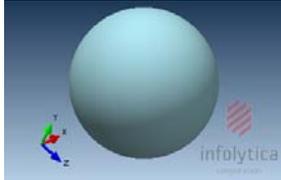
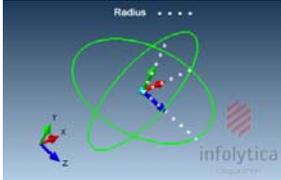
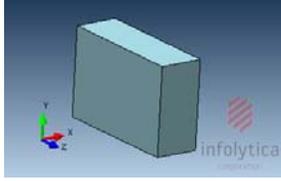
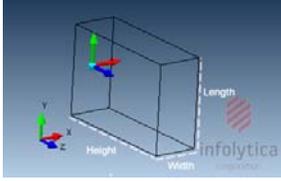
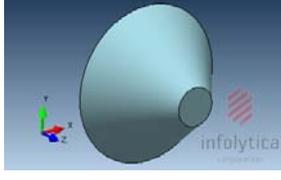
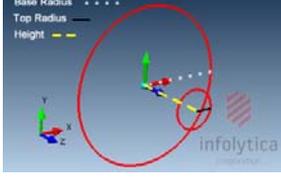
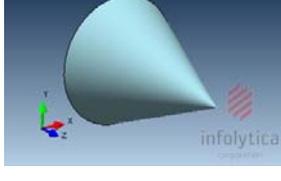
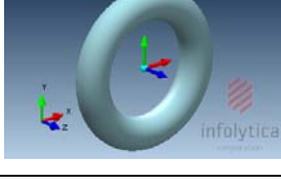
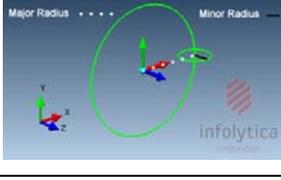
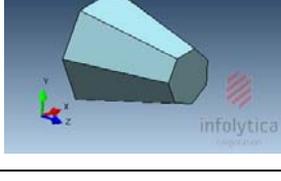
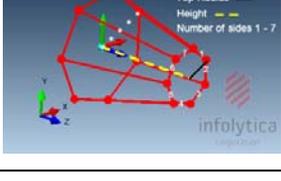
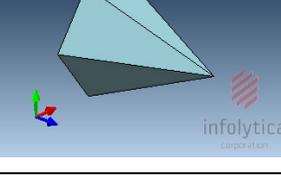
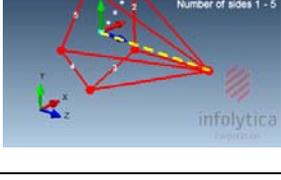
Modifying component edges (chamfer or fillet)

This feature allows you to modify your model at the component level by selecting an edge, or edges, and transforming them to a chamfer or rounded edge.



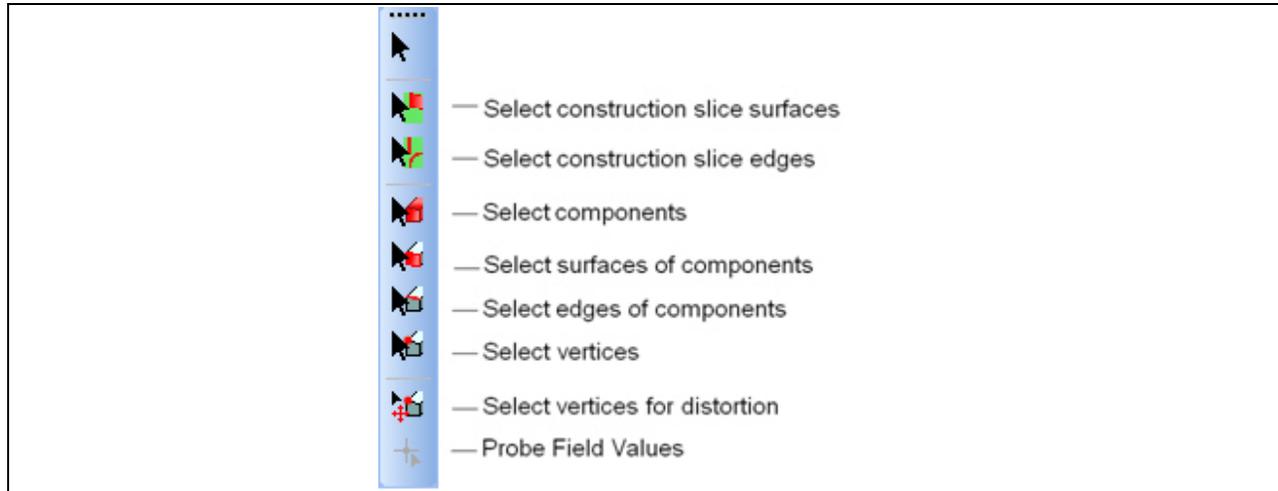
Creating components using the CSG Modeling technique

Various shapes and forms can easily be created using a modeling technique known as Constructive Solid Geometry, or CSG.

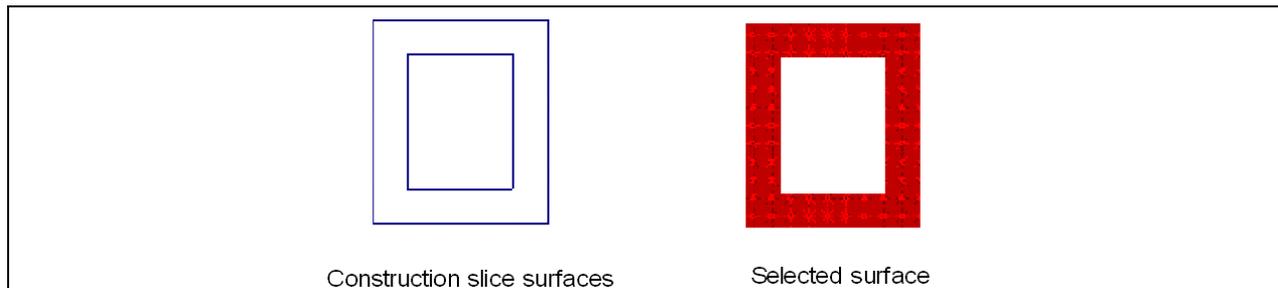
<p>Sphere</p>		
<p>Rectangular Block</p>		
<p>Cylinder</p>		
<p>Cone</p>		
<p>Torus</p>		
<p>Prism</p>		
<p>Pyramid</p>		

Selecting edges, surfaces, and components

Objects are selected with the mouse pointer using one of the selection tools on the Edit menu or Selection toolbar, or by creating a selection box.

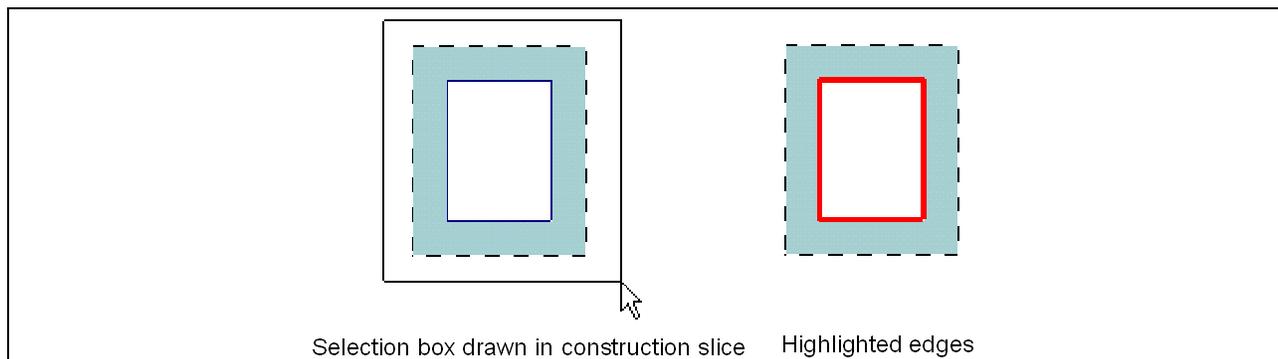


An object must be selected before a property or action can be applied to it. For example, a construction slice surface must be selected before it can be made into a component. The object is highlighted when it is selected.



Selection box

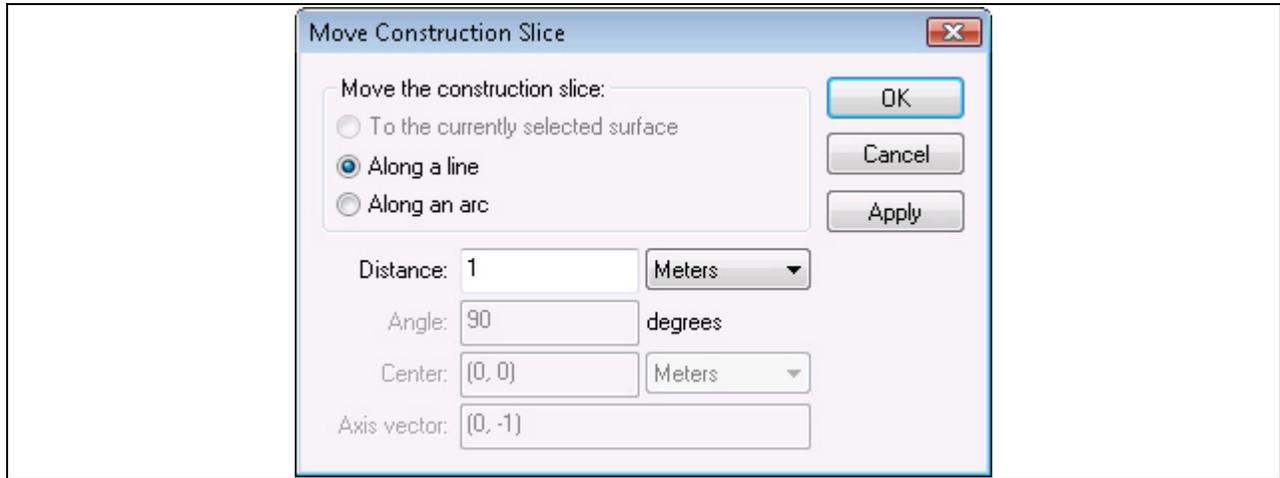
You can draw a selection box to highlight several objects at once. A selection box is also useful to highlight only certain items. For example, to find all the available edges on the construction slice, you can draw a selection box (using the select Construction Slice Edges selection tool) to highlight the edges.



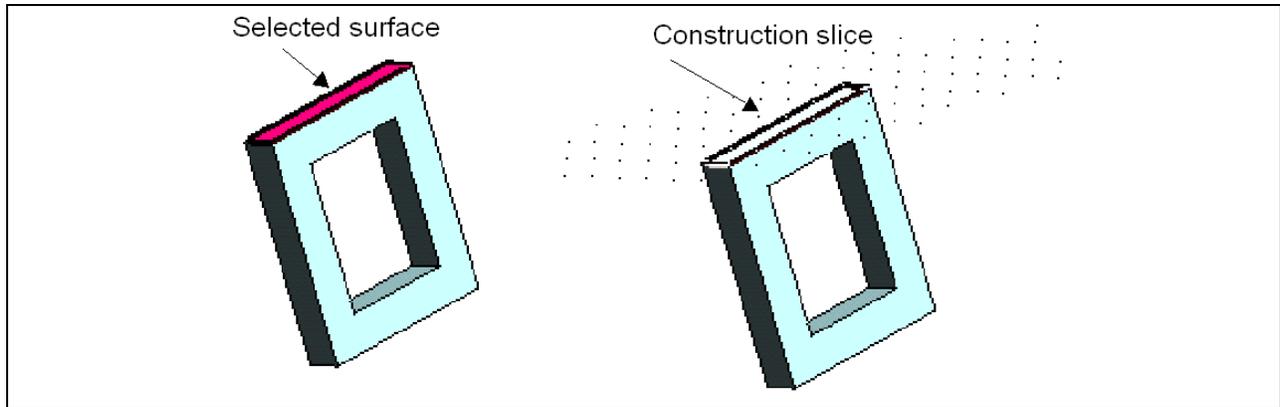
Positioning the construction slice

The construction slice is a two-dimensional editing plane in the *View* window that can be moved forward and backward in space.

The initial position of the construction slice is in the XY plane of the global XYZ coordinate system. The slice is first located at Z=0. The construction slice can be moved forward and backward using the *Move Construction Slice* dialog box. This dialog is accessed from either the *Draw* toolbar or the *Draw* menu.

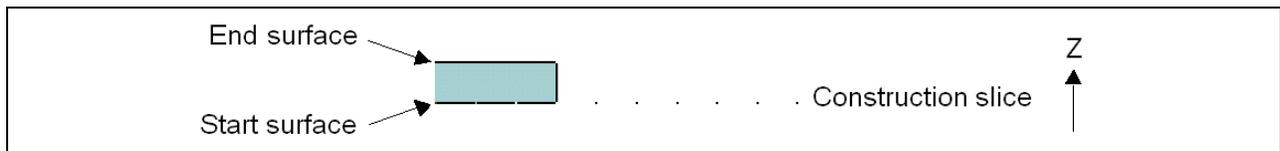


The construction slice can also be moved to a selected surface of a component.



When a component is swept, the start surface of the component begins on the construction slice. The end surface of the component is determined by the sweep distance set in the *Make Component* dialog.

Note The construction slice does not move when the component is swept.



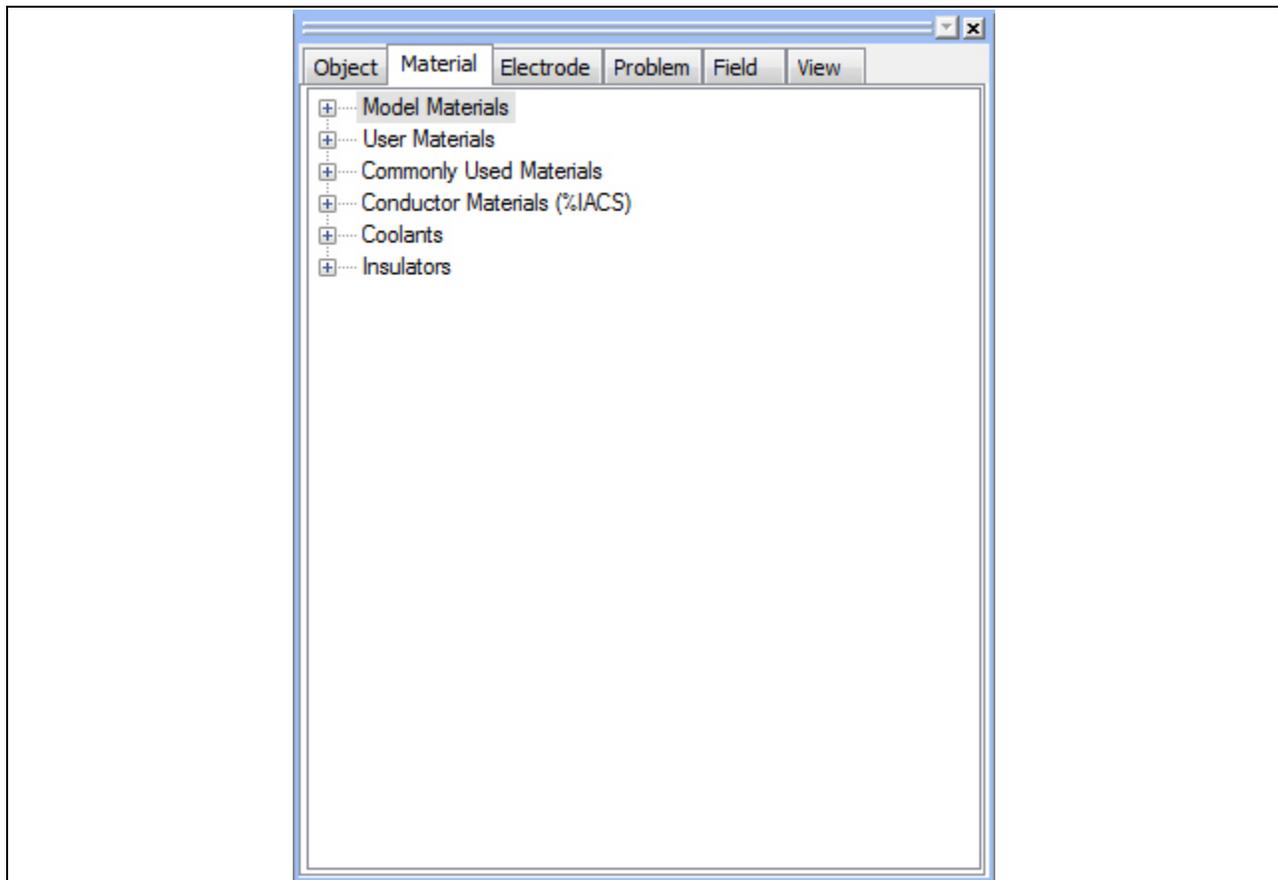
Materials

Materials are added to the component during the sweeping process.

- The *Model Materials library* lists all materials assigned to the device.
- The *User Defined Materials library* contains material that you have created or modified.
- The Materials page contains hundreds of pre-defined materials (sorted by database) that can be applied to the model, including electrical conductor and electrical insulator materials. Each material can be assigned to several categories.

Note Any of these pre-defined materials can be modified to make a user-defined material; you must first copy the pre-defined material to the User-defined materials library and then make the appropriate changes in the Material Property dialog.

The contents of the material library are shown in the Material page of the Project bar.



Boundary conditions

Boundary conditions define the behavior of the electric field at the boundaries of the model. Boundary conditions are applied to surfaces of the model, or to surfaces of an air box that represents an artificial outer boundary that surrounds the model. Conditions of symmetry can also be represented by using the appropriate boundary condition.

ElecNet provides five boundary conditions:

Ground: Constrains the electrical potential to zero. The electric field is made normal (perpendicular) to the boundary.

Flux Tangential: Constrains to zero the normal component of the electric flux density. The flux is made to flow tangential to (along side) the boundary. The Flux Tangential boundary condition is applied by default to all surfaces of the model that are not assigned the Flux Tangential boundary condition.

Even Periodic: If symmetry conditions exist, you can use the Even Periodic boundary condition to model sections of a periodic structure with an even number of poles. The mesh nodes on one plane of symmetry are related to the mesh nodes on the other side.

Odd Periodic: If symmetry conditions exist, you can use the Odd Periodic boundary condition to model sections of a periodic structure with an odd number of poles. The mesh nodes on one plane of symmetry are related to the mesh nodes on the other side.

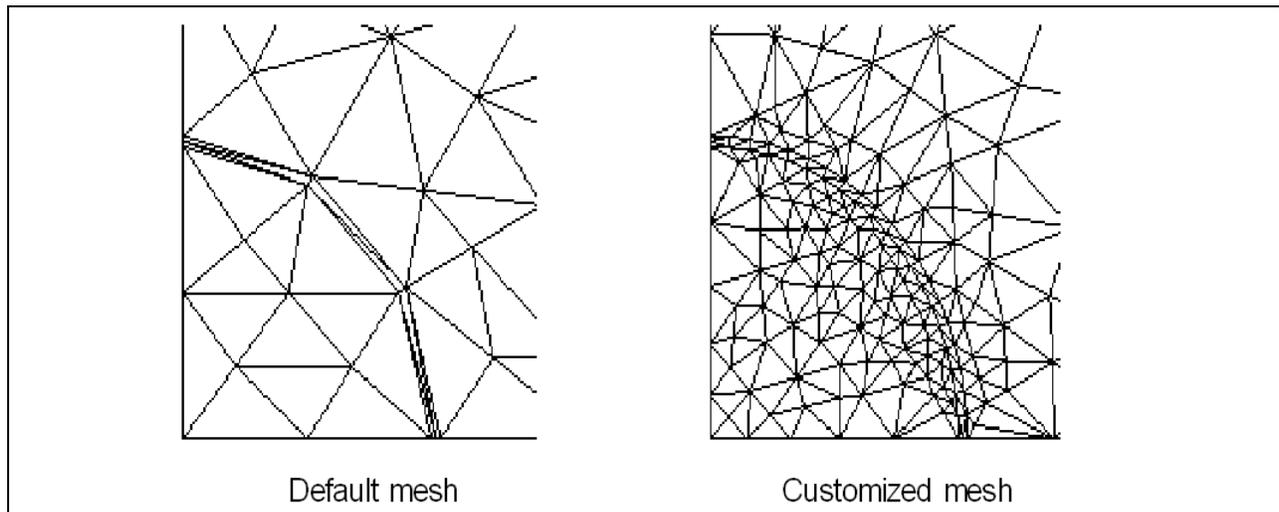
Thin resistive sheet: Requires the user to specify the material name and sheet thickness.

Finite element mesh

In the finite element method of analysis, the model is divided into a mesh of elements. The field inside each element is represented by a polynomial with unknown coefficients. The finite element analysis is the solution of the set of equations for the unknown coefficients.

The accuracy of the solution depends upon the nature of the field and the size of the mesh elements. In regions where the direction or magnitude of the field is changing rapidly, high accuracy requires small elements or high polynomial orders (or a combination of both).

ElecNet provides you with control over the size of the mesh elements. You can change the size of the elements for the entire model, or only in areas of interest.



Adaption

ElecNet's adaption process automatically identifies the areas of the mesh most in need of improvement and refines the mesh (h-adaption), or increases the polynomial order of the elements (p-adaption), in those areas.

ElecNet's adaption is controlled by adaption options that are set before solving begins. These options determine:

- the type of adaption method (h-adaption or p-adaption)
- the percentage of elements of the mesh that are refined during each adaption step
- the adaption convergence tolerance
- the maximum number of adaption steps

The Adaption Options are set in the *Adaption Options* properties page.

Solving the model

ElecNet solves Maxwell's equations to find the electric field within the model. The solution can be Electrostatic, DC current flow, Time-harmonic, or Transient for either 2D or 3D models.

ElecNet also offers an adaption process that automatically identifies and refines the areas of the mesh most in need of refinement to improve the quality of the solution.

The computed electric fields are viewed as shaded, arrow, or contour plots or as field animations. In addition, ElecNet automatically extracts from the field solution certain parameters of interest (depending on the solution type).

Electrostatic

- Total electric stored energy
- Force and torque on each body
- Net charge on each electrode
- Voltage across electrode

DC Current Flow

- Ohmic loss in each component
- Total current flowing out of each electrode
- Voltage across electrode

Time-harmonic

- Time-averaged electric stored energy
- Time-averaged force and torque on each body
- Net charge on each electrode
- Time-averaged Ohmic loss in each conducting component
- Total current flowing out of each electrode
- Total displacement current for each electrode
- Voltage across electrode

Transient

- Instantaneous electric energy
- Force and torque on each body
- Ohmic loss
- Charge on electrodes
- Conduction current on electrodes
- Displacement current on electrodes
- Voltage across electrode