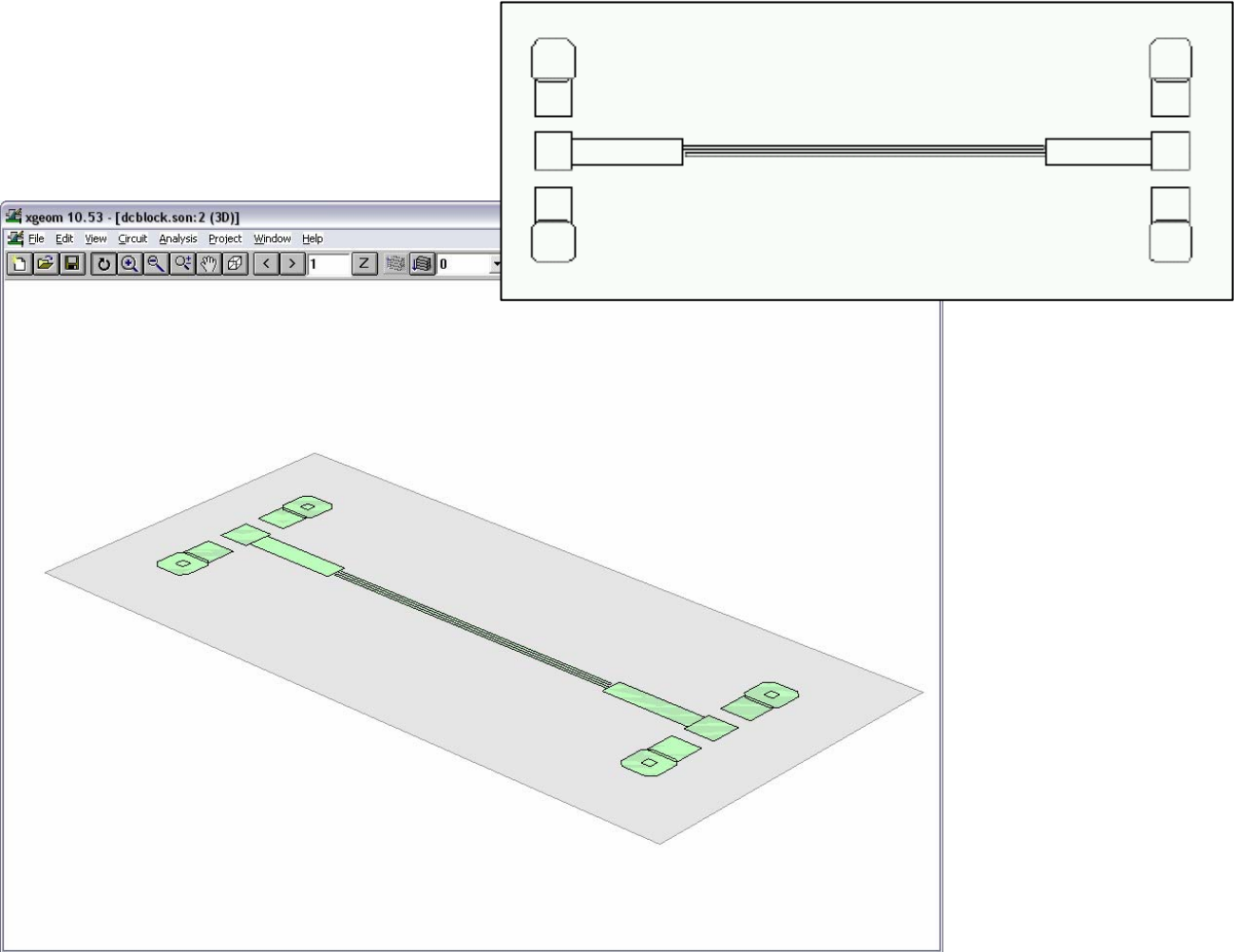


Using DXF Translator in Sonnet

Sonnet Application Note: SAN-203A



Description of Sonnet Suites Professional

Sonnet Suites Professional is an industry leading full-wave 3D Planar Electromagnetic (EM) field simulation software based on the Method of Moment (MoM) technique which accounts for all coupling and radiation effects from DC to THz. It also takes full advantage of mathematically robust and reliable FFT formulation which avoids time consuming, error prone numerical integration. Both MoM and FFT combined gives Sonnet an added assurance that it will give outstanding accuracy every time on problems that have traditionally been difficult to solve. Problems with high dielectric constant, thin dielectric layers and/or small dimensions with respect to the wavelength are handled especially well with Sonnet. Sonnet continues to be an indispensable tool for designers involved in RF/Microwave circuits such as distributed filters, transitions, Low Temperature Co-fired Ceramics, multi-layer RF packages, coplanar waveguides, and antennas. In addition, Sonnet has proven successful in mm-wave designs as well as in EMC and EMI analysis.

Sonnet Professional Key Benefits

- Accurately model passive components (inductors, capacitors, resistors) to determine values like RLC and Q factor
- Accurately model multi layer interconnects and via structures
- Generate a technology accurate electrical model for arbitrary layout shapes
- Quantify parasitic coupling between components, interconnects and vias
- Include substrate induced effects like substrate loss and eddy currents
- Visualize the current flow in components, interconnects and vias

Sonnet Professional Key Features

- FFT based Method of Moments analysis for ultimate reliability and accuracy
- Easy to learn, easy and efficient to use
- Only one high precision analysis engine – no need to switch between solvers
- Patented Conformal Meshing strategy for very efficient high accuracy meshing of curved structures
- Finite thickness modelling (including advanced N-sheet model)
- Dielectric bricks for truncated dielectric materials (e.g. MIM capacitor)
- Adaptive Band Synthesis for fast and reliable frequency sweeps with a minimum number of EM samples - more efficient than traditional approaches
- Easy to use data display for analysis results, including R, L, C, Q evaluation
- Equation capability for pre-defined or customized calculation on simulated data
- All configuration and technology setup is menu / dialog based– no need to edit configuration text files
- Remote simulation capability
- Compatible with the LSF cluster and load balancing system
- Seamless integration with Cadence® Virtuoso®, Agilent EEsof EDA's ADS, AWR® Microwave Office® and Analog Office™ and Eagleware-Elanix GENESYS™ design environments
- Sonnet Software Inc. is a Cadence Connections partner

When to Use Sonnet Professional Analysis

- When parasitic coupling is present.
 - Parasitic coupling is not always easy to predict without using electromagnetic analysis. Even elements which are "sufficiently" far apart can suffer from parasitic coupling: inductive or capacitive coupling, resonance effects due to grounding and surface waves that might propagate at the substrate boundary under certain conditions. Sonnet Professional analysis is based on the physical properties of your technology and will account for such physical effects.
- When accurate circuit models are not available or circuit model parameters are out of range.
 - Model based circuit simulators are based on models for a specific application, with limited parameter range. For example, only selected geometries, substrate types and substrate parameters are available. It is difficult to estimate the error induced by parameter extrapolation, so using models outside their designed parameter range is not suitable for critical applications.
 - Whenever a layout feature cannot be described by a circuit model, due to its geometry or technology, the physics based analysis with Sonnet Professional will provide the answer. An example for this could be a special inductor, capacitor or transformer which is not included in the design kit. Sonnet can be used to analyze those components "on the fly", or generate a full library of components models with trustworthy electrical results.



Introduction

The DXF translator allows you to convert a DXF file to a Sonnet project compatible file. Once you have converted your DXF file to a Sonnet project, you then need to tweak it using the project editor before you can analyze the circuit with Sonnet. The purpose of this application note is to describe a simple example where a DXF file containing a coupled line structure is imported into Sonnet and analyzed. This paper discusses some advanced features of the project editor and assumes that the user is very familiar with the project editor.

Note: The DXF translator is only available if you have purchased a DXF and/or GDSII translator license from Sonnet. Please see your system administrator if you are unsure of the availability of these programs.

Converting your files to Sonnet

Determine Level Mapping

First you must determine the mapping of DXF layers to project editor levels. To do this you import the DXF file with the default layer mapping. Then use the resulting project to determine what layers you wish to retain from your DXF file. Perform a second import of the same file, this time editing the contents of the Layer Mapping dialog box and saving the settings to a layer mapping file for use in subsequent imports.

When you select File Import DXF from the project editor menu, the following occurs:

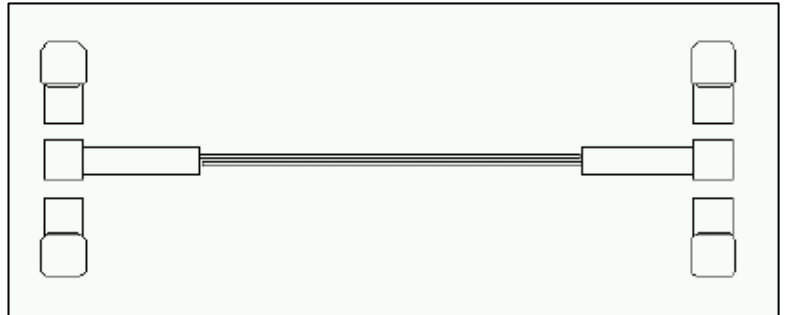
1. A Browse window opens which allows you to select the DXF file you wish to import. For this paper, a DXF file named "dcblock.dxf" will be used as an example.

2. Once you select the DXF file for import, the Import Control dialog box appears which allows you to assign the project (in this case, dcblock.SON) to which you wish to import the file.

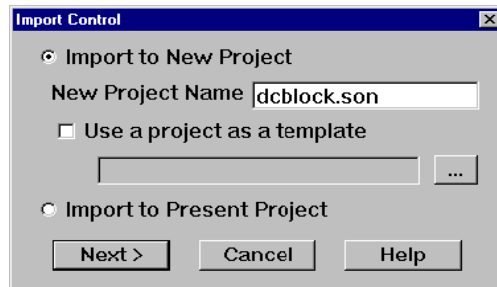
3. Click on Next button to continue. Then the project editor reads in the layers from the DXF file and the Import dialog box appears.

Once the DXF file has been imported, you normally need to perform Layer Mapping to map the layers into Sonnet metal levels.

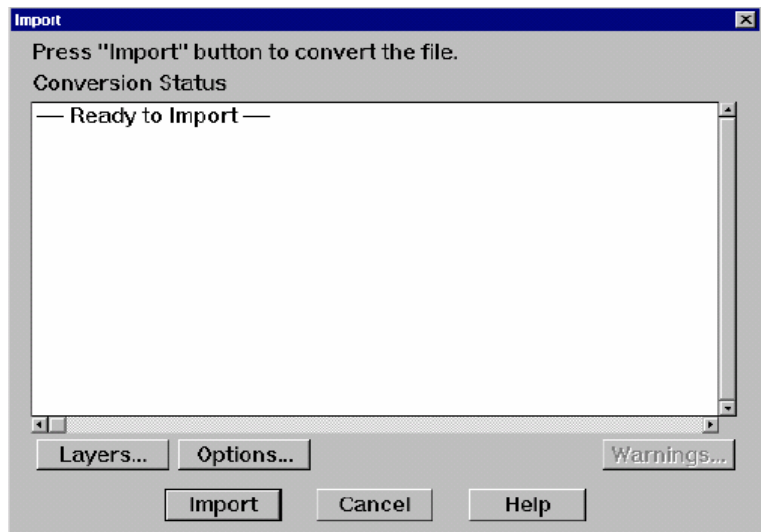
4. Click on the Layers button to open the Layer Mapping dialogue box.



A DXF example file called "dcblock.dxf" containing a coupled line structure



Import Control Dialogue Box



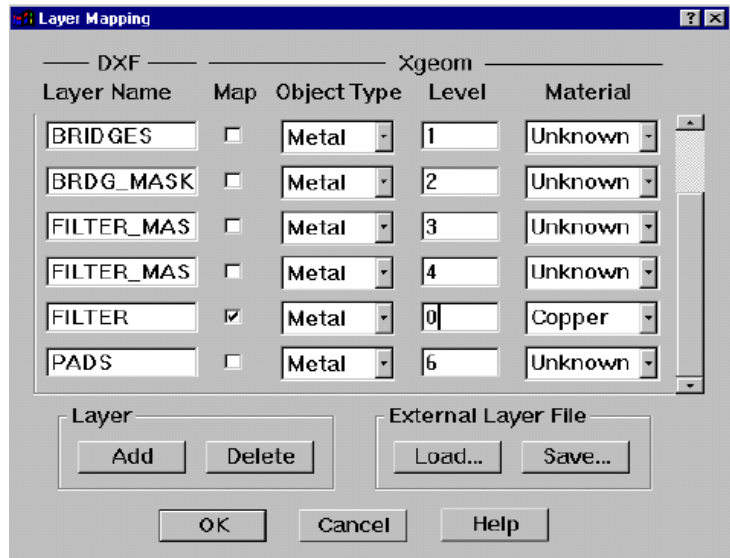
Import Dialogue Box

4. Click on the Map checkbox for all the layers that you wish to import into Sonnet.

For this example, the layer 5 (Filter layer) has all of the information that is needed to do an Electromagnetic (EM) analysis so it is the only layer selected. The other layers will be ignored.

Xgeom Level of "0" maps the Filter layer into the first metal level in the Sonnet project editor.

5. Enter "Copper" in the Xgeom Material column in the same row and click on OK to continue.



Layer Mapping Dialogue Box

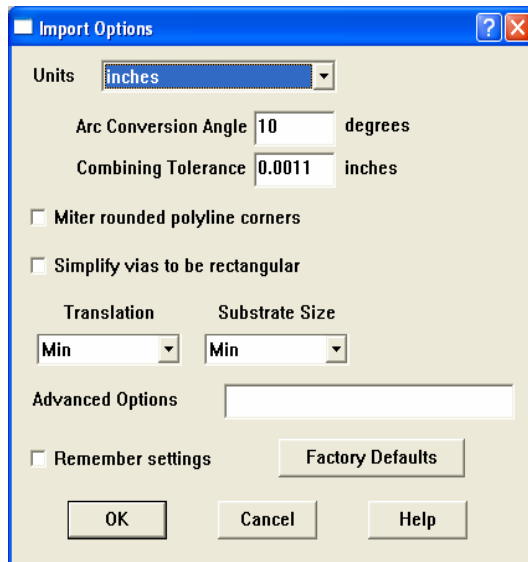
6. Click on the Options button in the Import dialogue box.

The Import Options dialog box appears on your display. This example was input in microns. Since the default Units value is inches, you need to change this before importing the circuit.

Note: It is helpful to have some understanding of the geometry and the drawing conventions used in the DXF file. For instance, knowing the drawing units is necessary for proper importation.

7. Select "microns" from the Units drop list.

8. Click on OK button to apply changes and click on Import button in the Import dialogue box to complete the import.



Import Options Dialogue Box

Make Final Adjustments within the Project Editor

Once the design has been imported into Sonnet project editor, you normally need to perform some minor adjustments to match the layout of your original DXF file.

Following are some items to consider when making these adjustments:

1. Define Dielectric Layer and Metallizations as you would in any normal project.

2. Remove Parts of the Circuit Not Being Used

You may have converted a much larger section of the circuit than you want to analyze. Thus you may want to delete sections of the circuit.

Also, you can use Edit → Clip to window out a part of the circuit you wish to analyze.

3. Decide on a Substrate Size and Cell Size

4. Change Polygons to Have Proper Fill

Change the polygon fill (subsection type) if needed. For example, you may need to change several polygons from Staircase fill to Diagonal fill. To change several polygons at one time, you can select multiple polygons then use Modify → Metal Properties.

5. Align the Circuit to Grid Points.

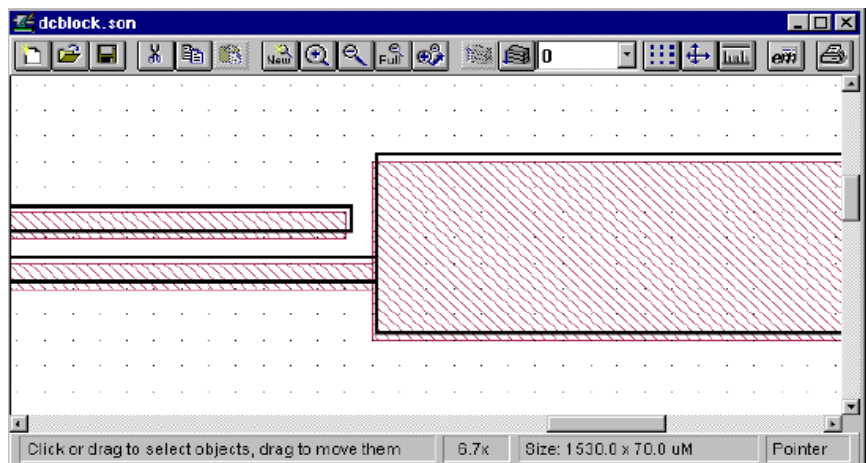
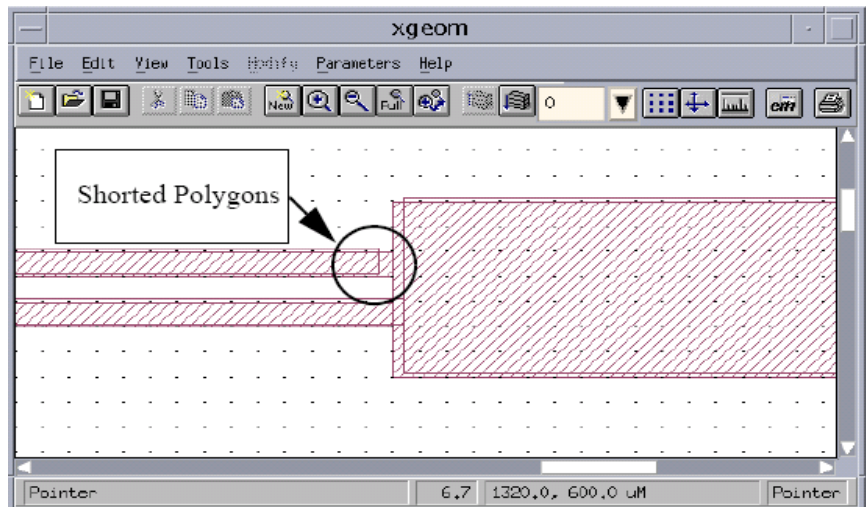
If you did not choose a small enough cell size or if your circuit is not oriented exactly on the grid points, the metal may “short” two polygons together. The problem can be fixed by moving the entire circuit by a fraction of a cell.

For this example, turn the cell snap off, using Tools → Snap Setup to open the Snap Grid Setup dialog box. Click on the No Snap radio button to turn the snap off. Click on the OK button to apply the changes and close the dialog box.

Now, using Edit → Select All, move your circuit so that the circuit is aligned to the grid points.

At this point you may want to snap all of the polygons to grid points. Select all of the polygons. Now select Modify → Snap to from the menu. Click on the X and Y radio button in the Cells section of the Snap Objects dialog box which appears. Then select the Preserve Spacing and Shape Relative to the Reference Point radio button. Click on the Select Reference Point button and select a reference point in your circuit. All other vertices in your circuit will be snapped relative to the position of this reference point so that the shape of the imported circuit is maintained.

When the dialog box reappears, click on the OK button to close the dialog box and snap the circuit to the grid. If desired, you can select only parts of the circuit to snap to the grid points.



Re-aligning the Circuit to the Grid

6. Move Points around as Needed.

Some points may now need to be moved. Pay particular attention to mitered corners and narrow lines and gaps.

This example needs to be centered. Make sure the snap is set to cell snap (Tools Snap Setup and select Cell Size) and choose Edit Select All. Now move your circuit to the approximate center of your substrate.

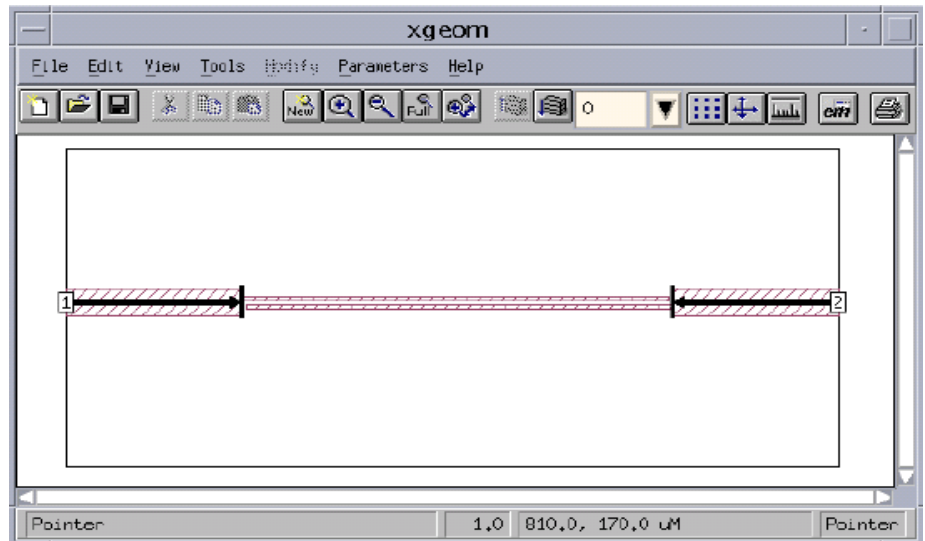
7. Add Vias as Needed.

The metallization being put down in a standard DXF file may only represent the mask dimensions and layers and not the actual physical dimensions or location of the via. You may need to create each via by hand.

8. Add Ports and Reference Planes

To finish the example, add ports and reference planes. Typically this entails extending transmission lines to bring the circuit out to the edge by using Tools Reshape and Modify Snap To. The finished circuit is shown below.

You may now analyze this circuit using Sonnet.



Adding Ports and Reference Planes

Sonnet Software, Inc.

Phone: 315-453-3096

Toll Free in North America: 877-7SONNET

Email: info@sonnetsoftware.com

Web: www.sonnetsoftware.com

United States Regional Sales:

Eastern US Sales Office: 203.439.0815

Western US Sales Office: 303.443.2646

Japan:

Sonnet Giken Co., Ltd.

Phone: 43-463-6663

Email: info@mail.sonnetsoftware.co.jp

Web: www.sonnetsoftware.co.jp

Germany, Austria, Netherlands:

Muehlhaus Consulting & Software GmbH

Phone: +49 (2302) 91438-0

Email: info@muehlhaus.com

Web: www.muehlhaus.com

UK, Ireland:

SJ Technologie

Phone: +44 (0)1536 524255

Email: John @ SJTechnologie.co.uk

Web: www.sjtechnologie.co.uk

Sweden:

Gritek Konsult AB

Phone: +46 8-24 2312

Email: amos.griner@gritek.se

Italy:

Medeos

Phone: +39 02 4586 2160

Email: info@medeos.it

Web: www.medeos.it

Taiwan:

Nearson Marketing Group

Phone: +88-6-3-5332541

Email: csw7786@ms8.hinet.net

China:

United Right Technology

Phone: +86-10-67082450

Email: urt@urtgroup.com

Web: www.urtgroup.com

India:

ICON Design Automation

Phone: +91-80-5272030

Email: idadpl@vsnl.com

Web: www.icon-dapl.com

Russia:

ElecTrade, Ltd.

Phone: +7-095-974-14-80

Email: potapoff@eltn.ru

Web: www.eltn.ru

