

OptiSPICE

Filter Parameter Extractor Manual

Filter Parameter Extractor Software for OptiSPICE

OptiSPICE 5.2



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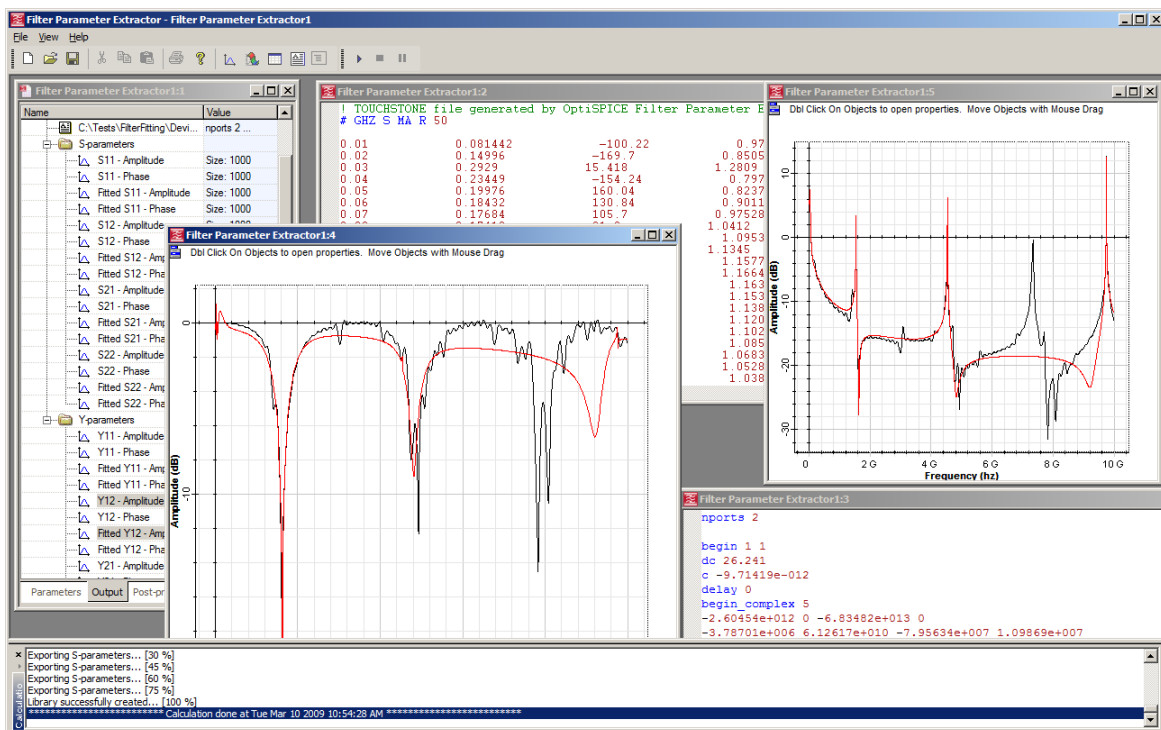
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Introduction

The Filter Parameter Extractor is a software tool that enables fitting of measured or calculated S-parameters with rational function approximations, using a pole-residue form. Filter Parameter Extractor employs the Vector Fitting algorithm, a pole relocation technique where the poles are improved on in an iterative manner [1].

Filter Parameter Extractor generates a rational function matrix file containing the poles-residue form of the fitted Y-parameters, calculated from the input S-parameters. OptiSPICE uses this file as an input to the S-Parameter and Optical filter elements.

Figure 1 Filter Parameter Extractor GUI



Main features

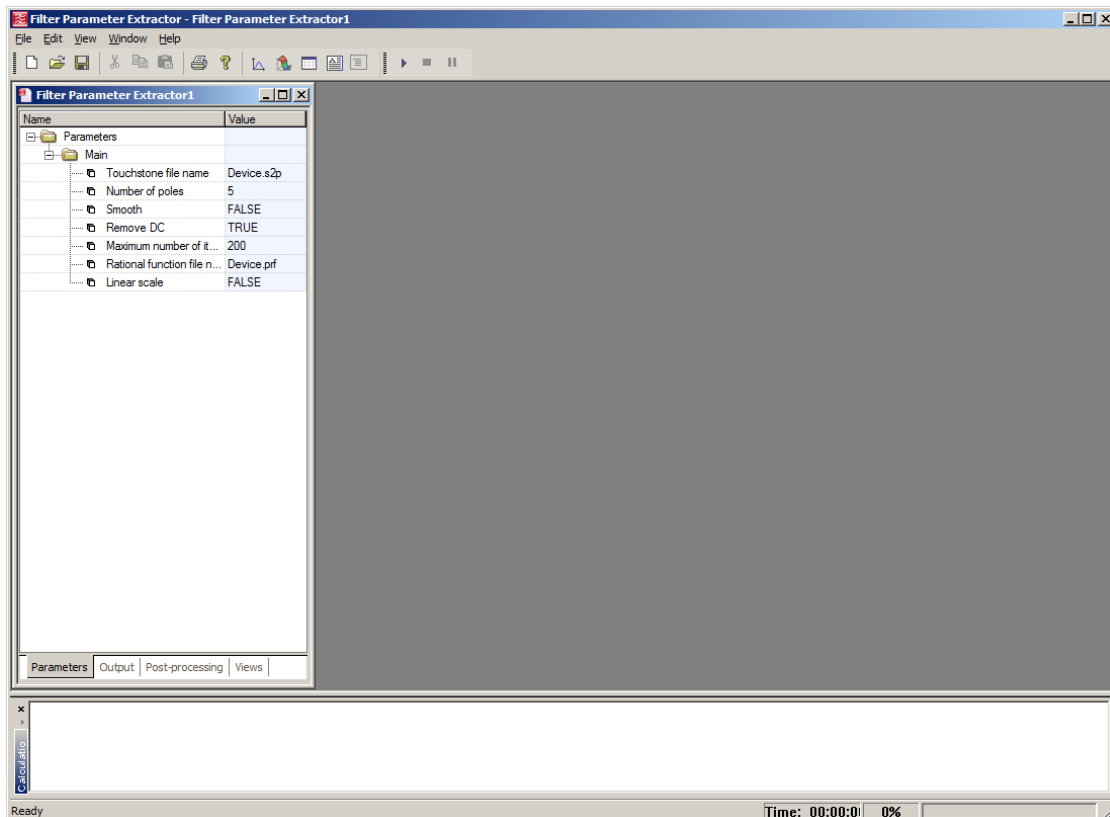
The main features of the Filter Parameter Extractor include:

Feature	Description
Graphical user interface	A comprehensive Graphical User Interface (GUI) controls the filter input parameters, output results, presentation graphics and post-processing.
Numerical engine	The numerical engine employs the Vector Fitting algorithm, known for its robust and efficient formulation, and enforcement of guaranteed stable poles.
Visualization capabilities	Powerful & intuitive result management allows users to graph almost any set of results available in design. Results are grouped into resizable, moveable views that supports text, tables, 2D and 3D graphs.
Post-Processing	A waveform calculators that uses standard Microsoft VBScript allows for unparalleled capability and flexibility to analyze simulation results.

Filter Parameter Extractor GUI

When you open the Filter Parameter Extractor, the application looks like [Figure 1](#).

Figure 1 Filter Parameter Extractor graphical user interface (GUI)



Main parts of the GUI

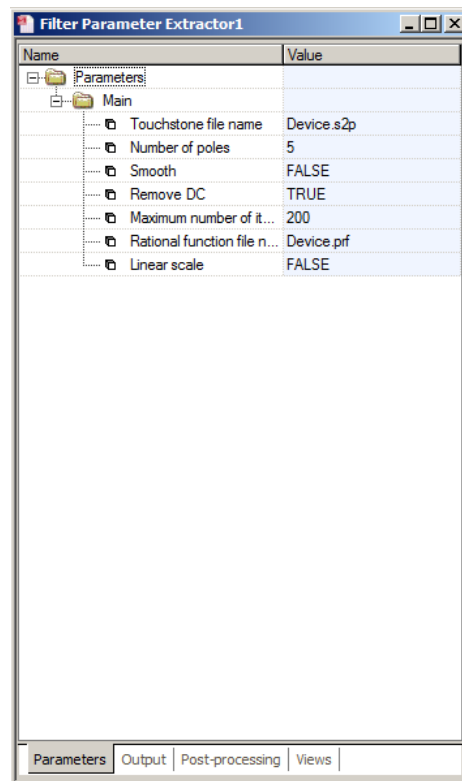
The Filter Parameter Extractor GUI contains the following main windows:

- [Project Browser](#)
 - [Parameters tab](#)
 - [Output tab](#)
 - [Post-processing tab](#)
 - [Views tab](#)
- [Calculator](#)
- [Calculation Output](#)
- [Views](#)
- [Status bar](#)
- [Menu bar](#)

Project Browser

Project browser allows the user to organize the project to achieve results more efficiently, and navigate through the current project. Access parameters, results and views.(see [Figure 2](#)).

Figure 2 Project browser (Parameters tab)



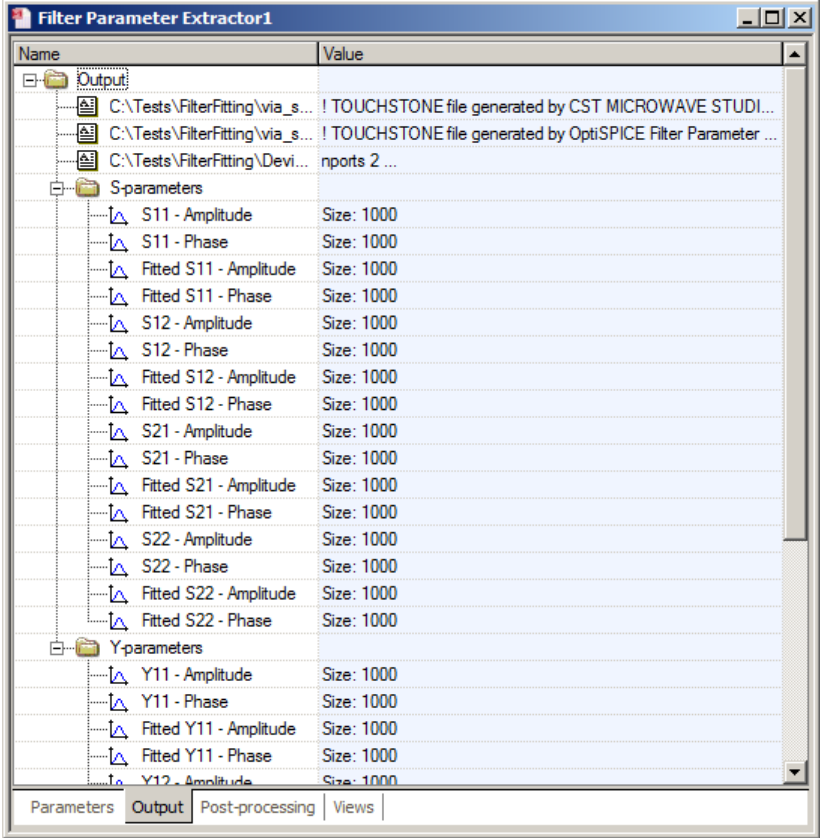
Parameters tab

Lists the properties of the current project. Users can access the parameter editor by double-clicking on any parameter in the list.

Output tab

Displays the results of the calculation (see Figure 3). User can drag-and-drop results into views or simply double-click on any result in order to launch the default view for a given result.

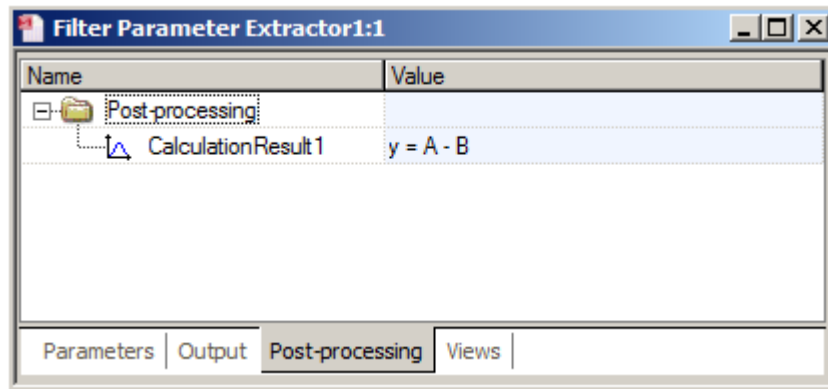
Figure 3 Project browser (Output tab)



Post-processing tab

Displays the post-processed results from the calculator (see [Figure 4](#)). User can drag-and-drop post-processed results into views or simply double-click on any post-processed result in order to launch the default view.

Figure 4 Project browser (Post-processing tab)

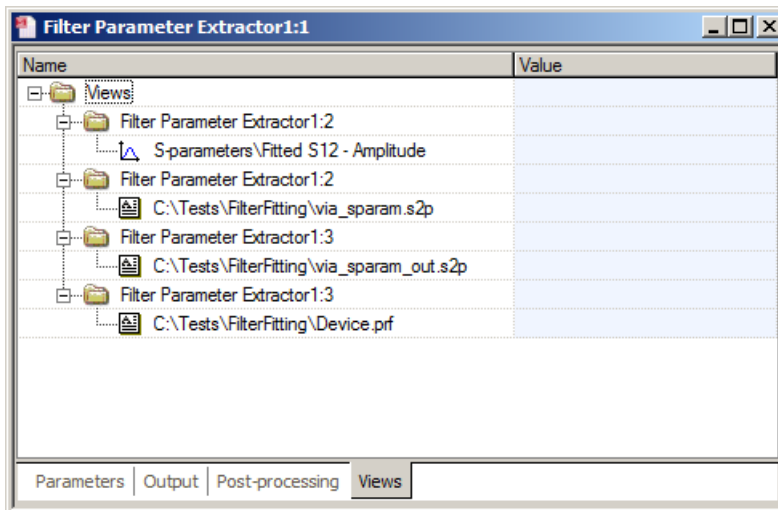


Views tab

Post-processing tab

Displays a list of views that represent active windows containing and displaying results (see [Figure 5](#)).

Figure 5 Project browser (Views tab)

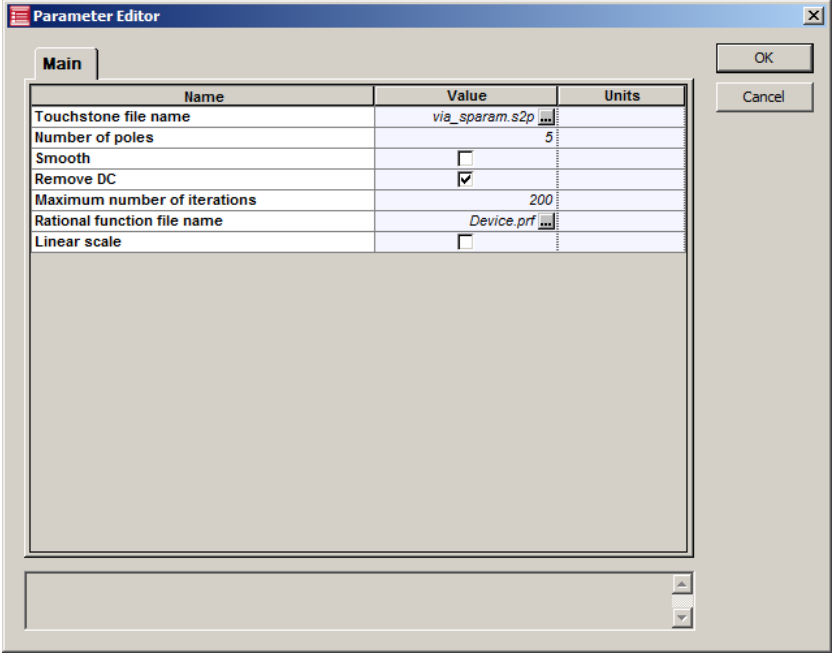


Parameter Editor

Double clicking on any parameter in the Project Browser will open the **Parameter Editor** (see [Figure 6](#)). The Parameter Editor allows you to view the list of global parameters of the active project.

Note: Please refer to the [Technical Background](#) for the description of the parameters listed in the editor.

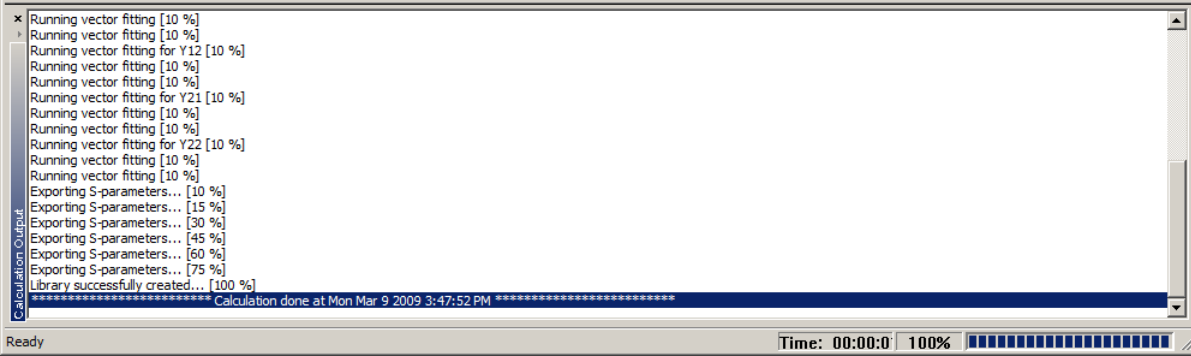
Figure 6 Parameter Editor control



Calculation Output

Information regarding the progress of the calculation is displayed in the Calculation output (see [Figure 7](#)).

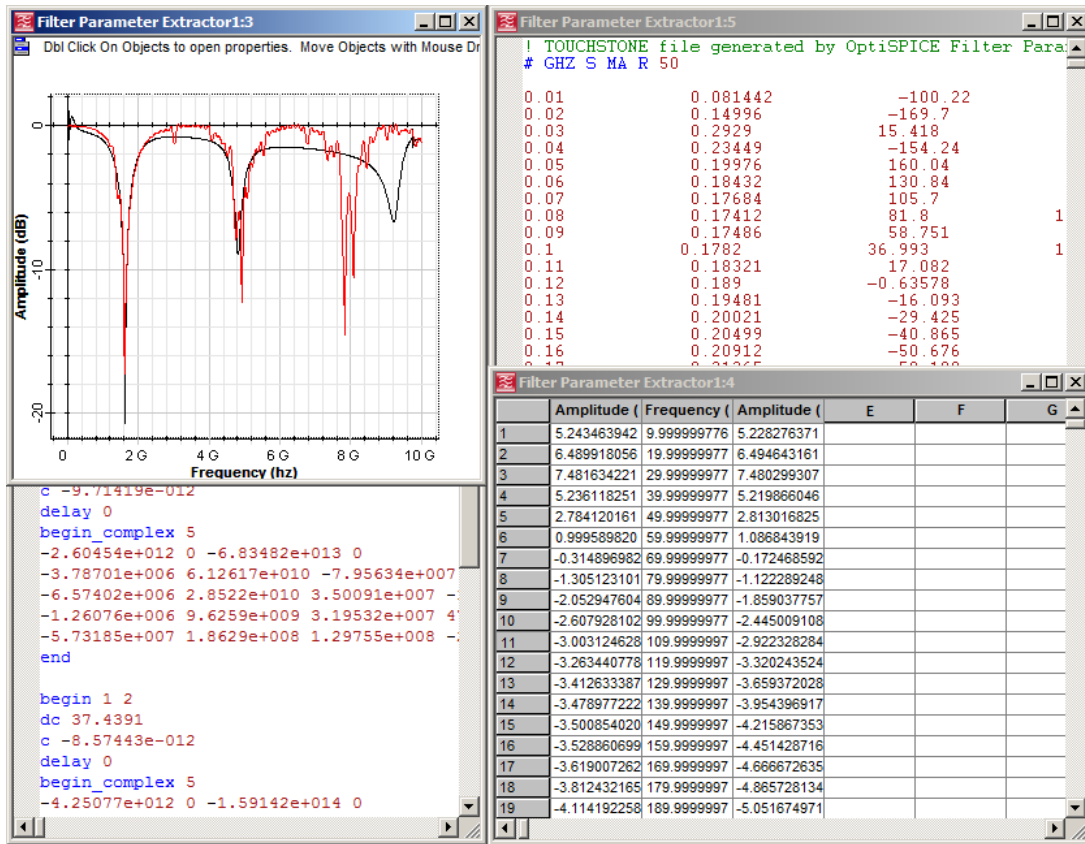
Figure 7 Calculation output



Views

Views are windows that contain results from calculation or post-processing (see Figure 8). They display 2D and 3D graphs, tables and text. A user can create an empty view by clicking in one of the toolbar buttons such as *Create 2D Graph View*, *Create 3D Graph View*, *Create Grid View* or *Create Text View*. Alternatively, by double-clicking on a result, a view will be automatically created or by selecting a result and clicking on the context menu (right-click) and selecting *View*.

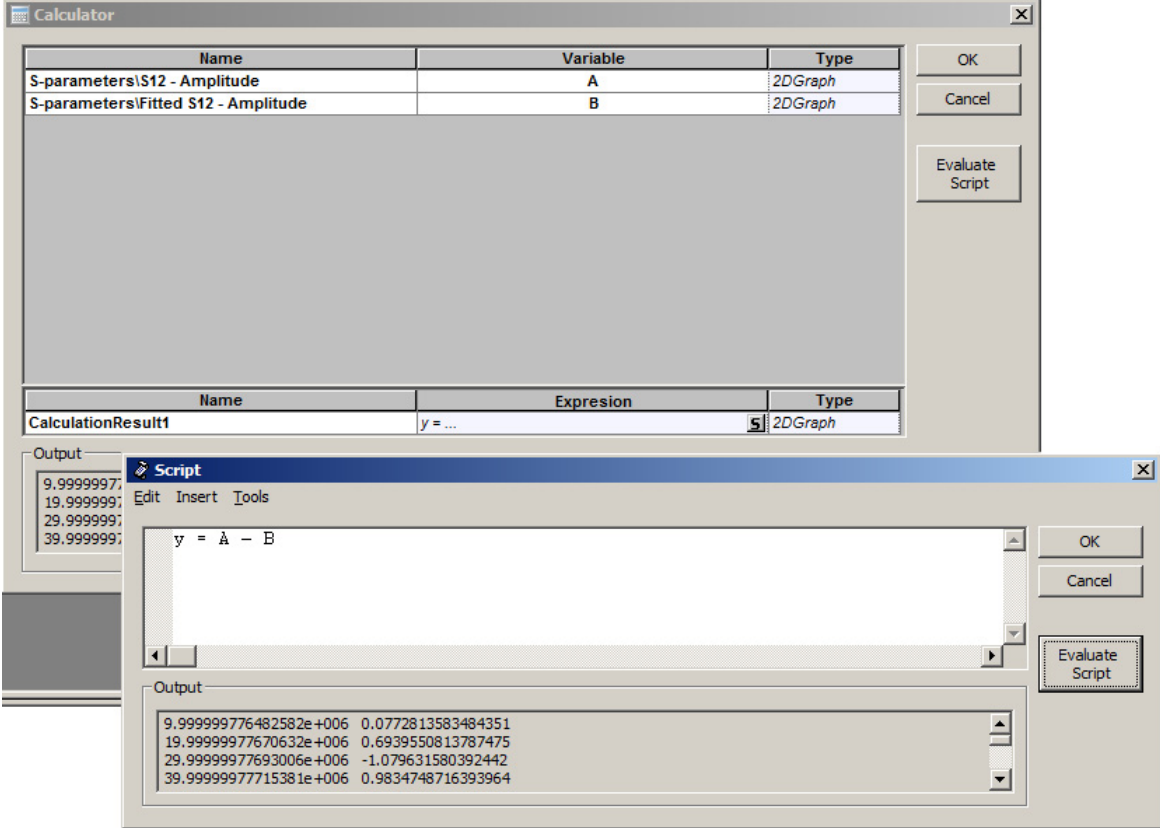
Figure 8 Multiple views



Calculator

The **Calculator** control allows you to operate on the output results to create new results and graphs. By selecting one or more results or 2D graphs the user can select the Calculator on the context menu (right-click). In order to create new results the user provides a script (Microsoft VBScript Language) that operates on the available variables - the output results **MUST** be provided to the Y variable.

Figure 9 Calculator



Status bar

Displays useful hints about using the Filter Parameter Extractor, the time and progress of the calculation (see [Figure 10](#)).

Figure 10 Status bar



Menu bar


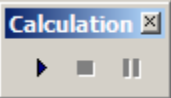
Contains the menus that are available in the Filter Parameter Extractor (see [Figure 11](#)). Many of these menu items are also available as buttons on the toolbars or from other lists.

Figure 11 Menu bar



Toolbars





You can select the toolbars that you want to have available in the main layout window. The toolbar options include:

Standard		Contains the buttons to perform all typical windows application actions, in addition to create views options.
Calculation		Calculate, pause or stop the project calculation.


Menus and buttons

This section describes the menus and buttons available in the Filter Parameter Extractor.





File menu

File menu item	Toolbar button	Description
New (Ctrl+N)		Create a new project.
Open (Ctrl+O)		Open an existing project. Select the project from the Open dialog box.
Close		Close the active (current) project. You are prompted to save changes.
Save (Ctrl+S)		Save the active (current) project under the current name in the default location.
Save As		Save the active (current) project with a different name and in a location that you select.
Print (Ctrl+P)		Print the active (current) project.
Print Setup		Set up the printer, page size, orientation, and other printing options.



File menu item	Toolbar button	Description
Print Preview		Preview the active (current) project.
Calculate (Ctrl+F5)		Calculate the active (current) project.
Recent files		List the most recent files that you worked on.
Exit		Exit the application. You are prompted to save changes to the project.

Edit menu

Edit menu item	Toolbar button	Description
Undo (Ctrl+Z)		Undo the last change made in the active (current) layout. You can undo all actions until the last saved operation.
Cut (Ctrl+X)		Remove all selected objects and place them on the clipboard.
Copy (Ctrl+C)		Copy selected objects to the clipboard. The selected objects remain in the active project.
Paste (Ctrl+V)		Copy objects from the clipboard and paste them in a user-defined location—the same layout, a new subsystem, or a new layout.

View menuWindow menu

View menu item	Toolbar button	Description
Toolbars		
Standard		Select to display the Standard toolbar.
Calculation		Select to display the Calculation toolbar.
Status Bar		Select to display the Status Bar .

Window menu item	Toolbar button	Description
Cascade		Arranges all open views in a cascading format.
Tile		Arranges all open views in a tile format.
Arrange icons		Lines up minimized views at the bottom of the application.

Help menu

Help menu item	Description
About Filter Parameter Extractor	Provides information about Optiwave Corporation—mailing address, telephone and fax numbers, E-mail address, and URL.



Quick Start

This section describes how to run a project, edit parameters, and obtain results.

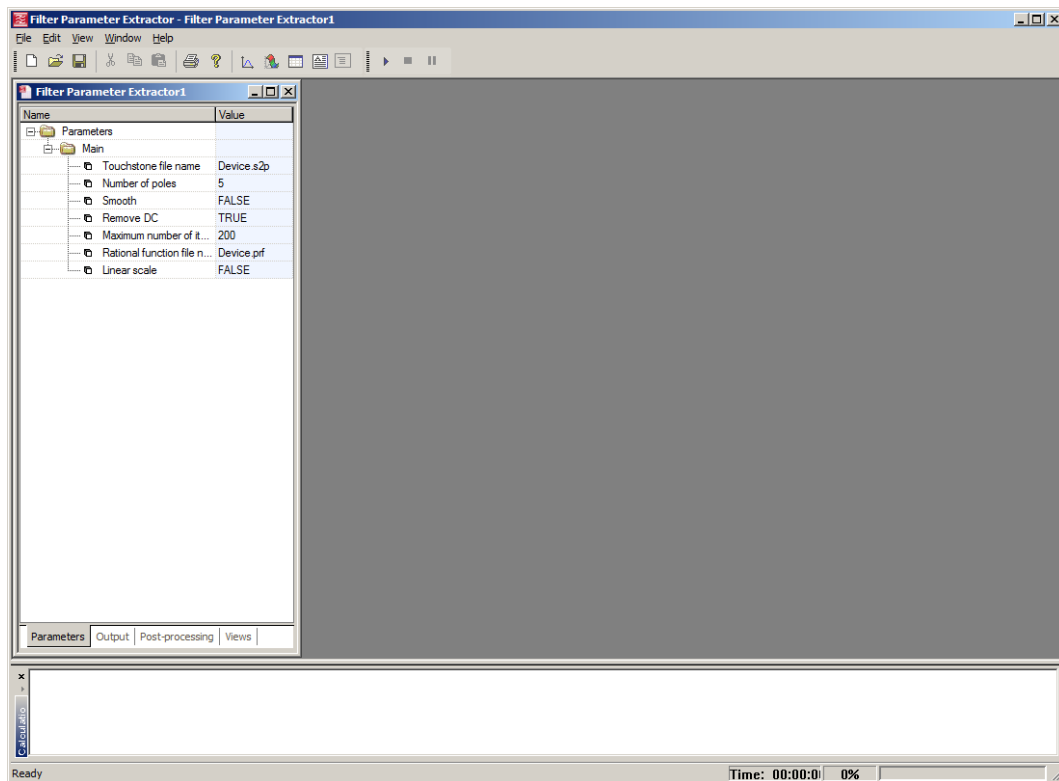
Starting Filter Parameter Extractor

To start **Filter Parameter Extractor**, perform the following action.

Action

- From the **Start** menu, select **Programs > Optiwave Software > OptiSPICE 1 > Filter Parameter Extractor**.
Filter Parameter Extractor loads and the graphical user interface appears (see [Figure 1](#)).

Figure 1 Filter Parameter Extractor graphical user interface (GUI)



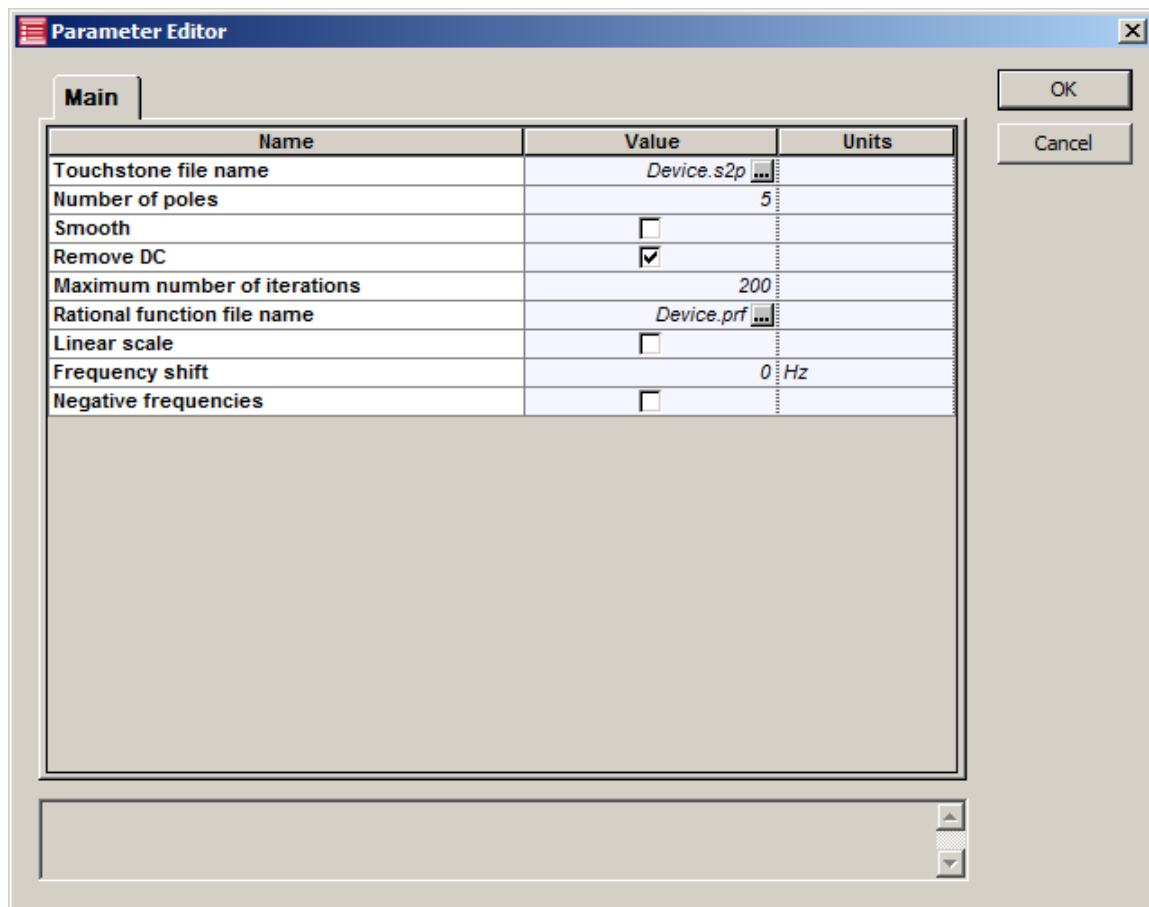
Viewing and editing parameters

To view and edit the project parameters perform the following action.

Action

- In the **Project Browser**, double-click on any parameter in the **Parameters tab** to view and edit the parameters for the project.
*The **Parameter Editor** (see [Figure 2](#)) dialog box appears.*

Figure 2 Parameter Editor



Parameters are organized by categories. **Filter Parameter Extractor** has one category represented by a tab in the dialog box:

- Main

Each category has a set of parameters. Parameters have the following properties:

- Name
- Value
- Unit

For a detailed description of each parameter in the Main tab please refer to [Technical Background](#).

Parameter settings to create a filter library for OptiSPICE

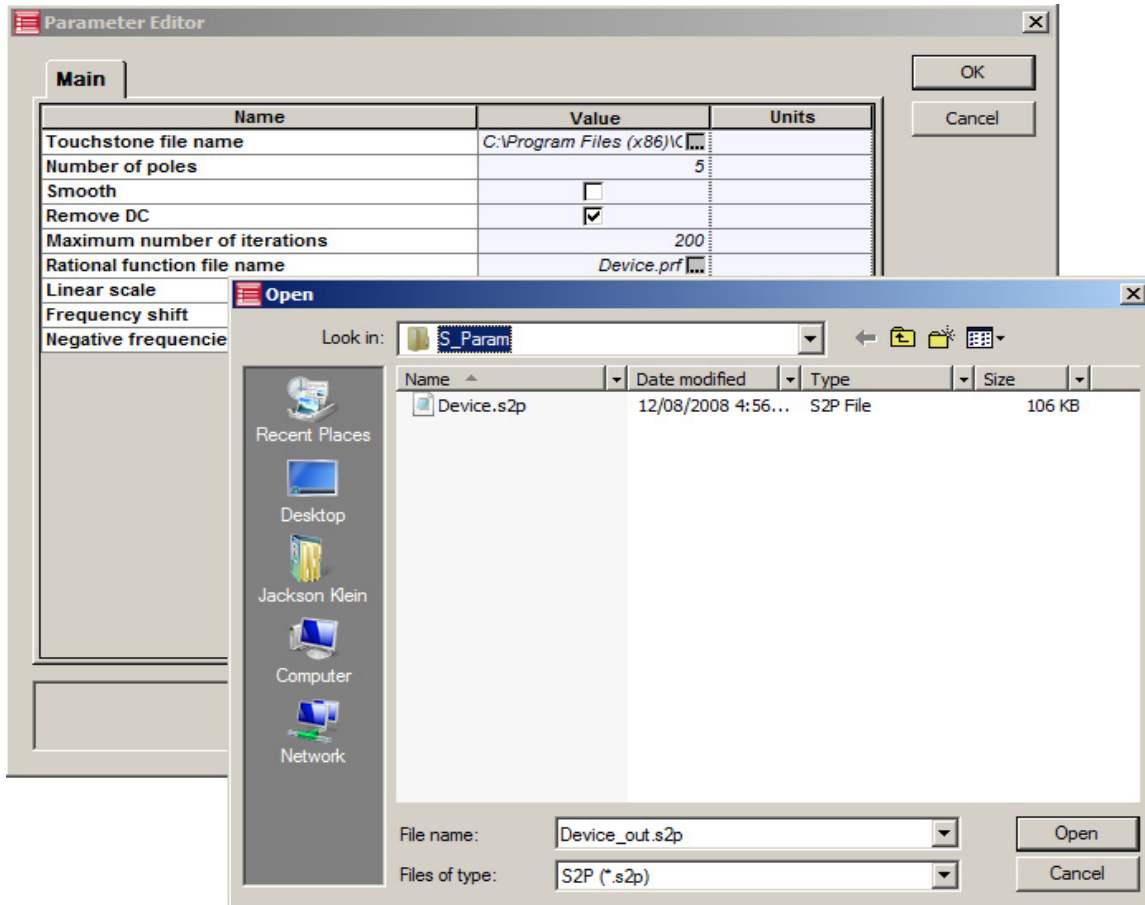
To create a filter library for OptiSPICE perform the following actions.

Step	Action
-------------	---------------

- | | |
|----------|--|
| 1 | In the Project Browser , double-click on any parameter in the Parameters tab to view and edit the parameters for the project.
<i>The Parameter Editor (see Figure 2) dialog box appears.</i> |
| 2 | Provide the <i>Touchstone file name</i> parameter - this is the file destination and the root name for the library (see Figure 3). |
| 3 | In the Parameter editor, click on 'OK'. |



Figure 3 Settings to create a filter library.



Running a simulation

To run a simulation again with the current filter parameters and create a library file for OptiSPICE, perform the following procedure.

Step Action

- 1 In the Calculation toolbar, click on 'Play' (see [Figure 5](#)).
The **Calculations** starts (see [Figure 5](#)).

Figure 4 Calculation toolbar

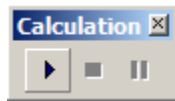
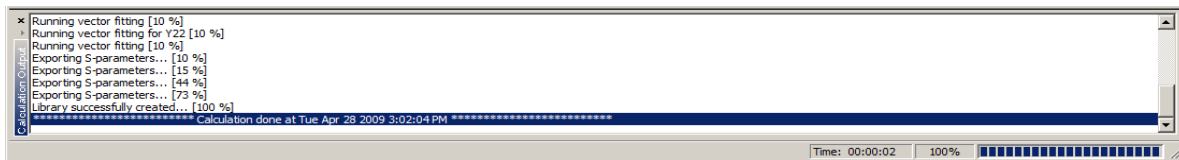


Figure 5 Calculation Output



At the end of the calculation the output tab will contain the results of the simulation.

Visualizing results

To view the results from the calculation, perform the following action.

Action

- 1 In the **Project Browser**, click on the **Output tab** to view the results for the project (see [Figure 6](#))
The list of results for the parameter fitting includes generated files (input and output S-parameters and rational function matrix data) and 2D Graphs (input and fitted S and Y-parameters)
- 2 Double-click on S21 - Amplitude result.
The 2D Graph view appears (see [Figure 7](#)).

Figure 6 Output results

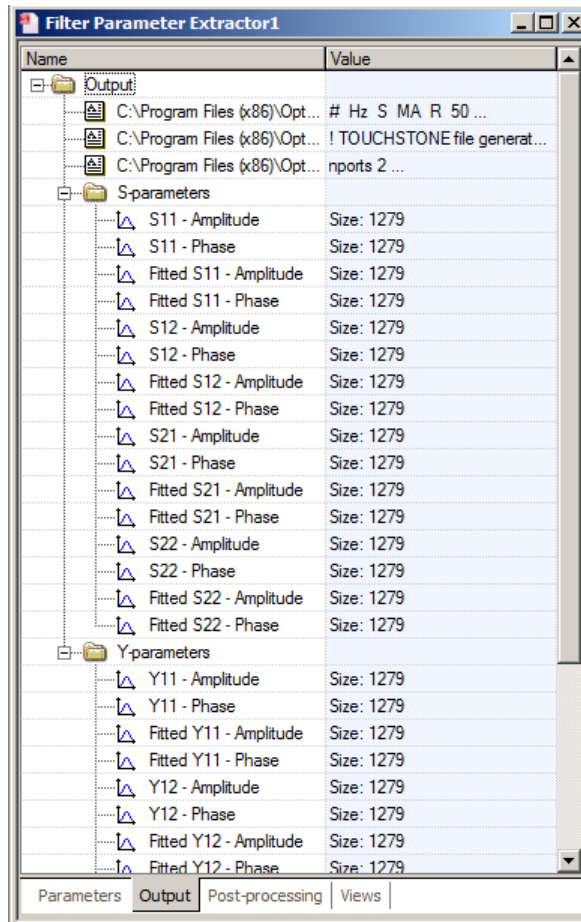
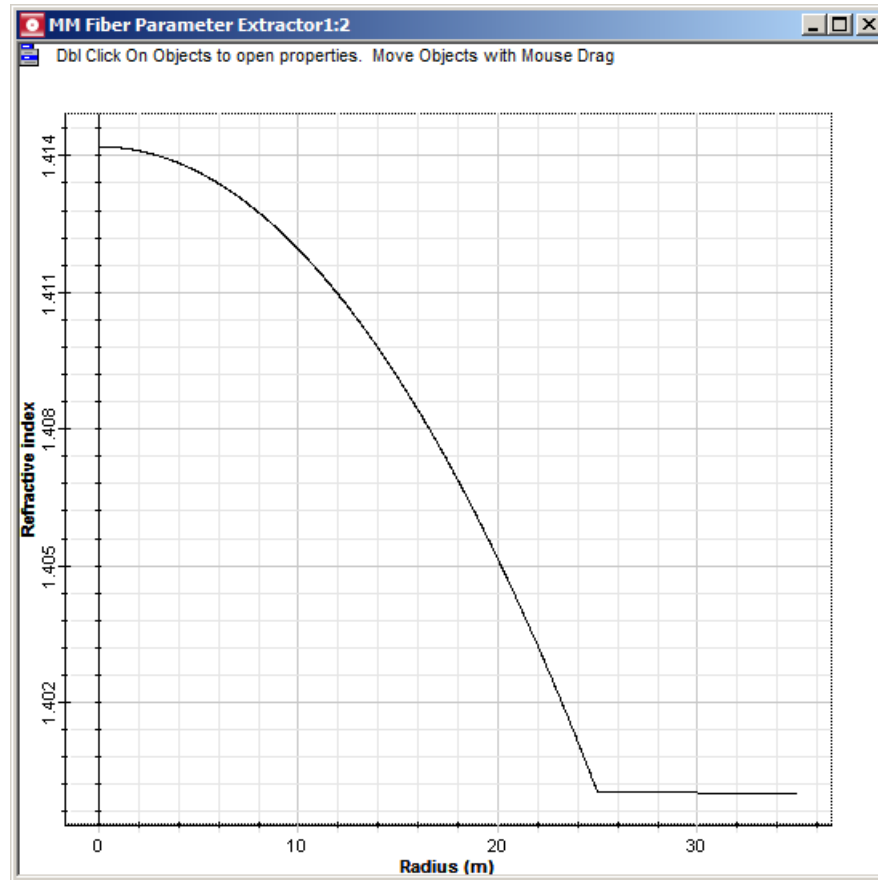


Figure 7 Input S21 - Amplitude



The number of graphs generated by the Filter Parameter Extractor depends on the number on the number of ports of the device. For a typical 2x2 device there are four S-Parameters (S11, S12, S21 and S22). For each S parameter there is corresponding Y parameter amplitude and a phase graph and the fitted version of the graphs.

The contents of device.s2p input S-parameters are depicted in [Figure 8](#). device_out.s2p contains the fitted S-parameter generated using the fitted pole-residue form ([Figure 9](#)). Finally, the rational function matrix is depicted in [Figure 10](#).



Figure 8 Input S-Parameters.

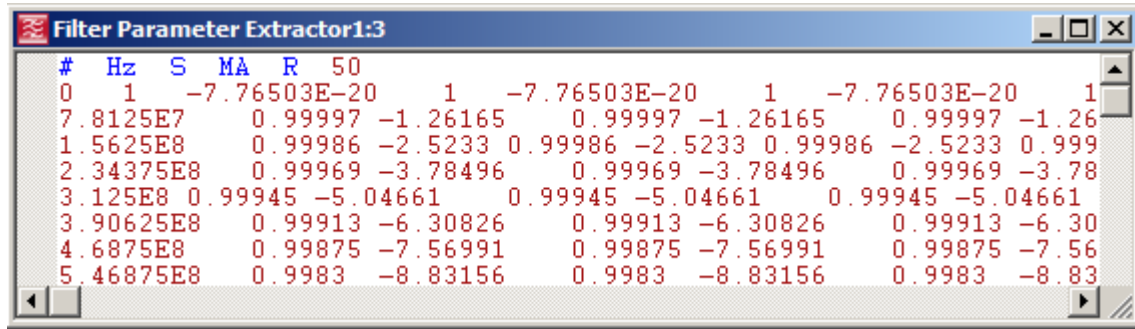


Figure 9 Fitted S-Parameters

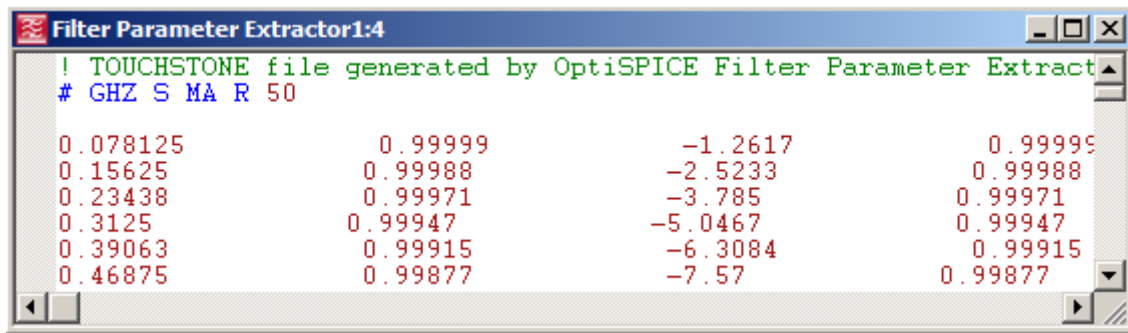
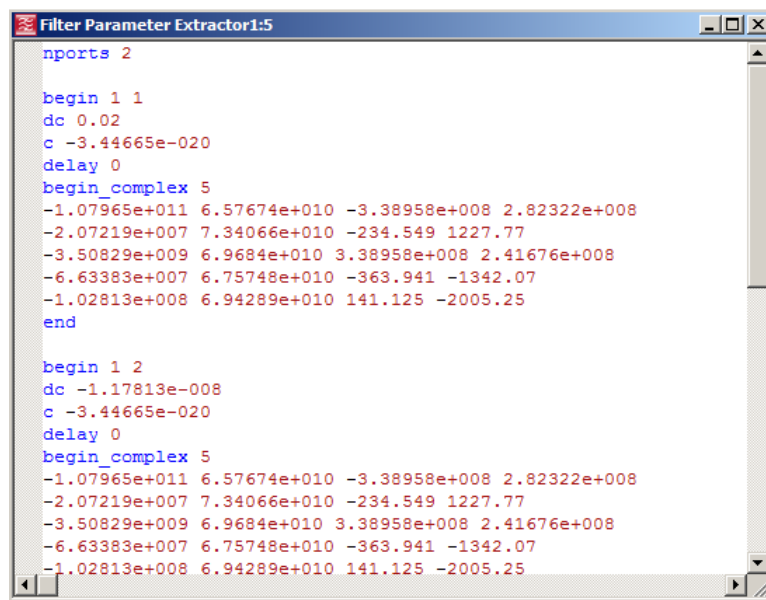


Figure 10 Contents of the file generated by the Filter Parameter Extractor.



Saving the project and closing Filter Parameter Extractor

To save the project and close the Filter Parameter Extractor, perform the following procedure.

- | Step | Action |
|-------------|--|
| 1 | From the File menu, select Save or Save As... |
| 2 | From the File menu, select Exit .
<i>Filter Parameter Extractor closes.</i> |



QUICK START

Notes:

Technical Background

Parameters

Main

Name and description	Default value	Default unit	Value range
Touchstone file name Touchstone type file containing s-parameters data	Device.s2p		
Number of poles The number of poles and residues for the numerical fitting	5		
Smooth Defines whether the fitting function is smooth (has real poles only) or not.	NO		[YES, NO]
Remove DC Defines whether to remove the DC component from the input data or not.	YES		[YES, NO]
Maximum number of iterations The maximum number of iterations for the numerical fitting	200		[10,10000]
Rational function file name The output file containing the list of poles and residues	Device.prf		
Linear scale Defines whether to plot the graphs using linear or log scale	NO		[YES, NO]

Technical Background

Filter Parameter Extractor employs the Vector Fitting algorithm [1]. The user provides a file (parameter *Touchstone file name*) containing the S-parameters following the

specification of the Touchstone file format. Parameter *Number of poles* defines the number of poles and residues for the numerical fitting. The user can set parameter *Smooth* to true in order to calculate a model with real-only parameters, or to false to calculate a model with real and complex conjugate parameters. Parameter *Remove DC* filters the DC component from the input S-Parameters, allowing for fast convergence.

OptiSPICE requires the pole-residue form of the fitted Y-parameters. Filter Parameter Extractor converts the S-Parameters into Y-parameters and run Vector Fitting on the Y-parameters. The fitted S-parameters are calculated from the fitted Y-parameters.

After the calculation a rational function matrix file is generated.

References

- [1] B. Gustavsen and A. Semlyen, "Rational approximation of frequency domain responses by Vector Fitting", IEEE Trans. Power Delivery, vol. 14, no. 3, pp. 1052- 1061, July 1999.





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