

OCEAN Reference

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Introduction to OCEAN

This topic provides an introduction to Open Command Environment for Analysis (OCEAN). See the following topics for more information:

- [Types of OCEAN Commands](#)
- [OCEAN Online Help](#)
- [OCEAN Syntax Overview](#)
- [Parametric Analysis](#)
- [Distributed Processing](#)
- [Plotting Simulation Results](#)

OCEAN lets you set up, simulate, and analyze circuit data. OCEAN is a text-based process that you can run from a UNIX shell or from the Command Interpreter Window (CIW). You can type OCEAN commands in an interactive session, or you can create scripts containing your commands, then load those scripts into OCEAN. OCEAN can be used with any simulator integrated into the Virtuoso® Analog Design Environment.

Typically, you use the Virtuoso® Analog Design Environment when creating your circuit (in Composer) and when interactively debugging the circuit. After the circuit has the performance you want, you can use OCEAN to run your scripts and test the circuit under a variety of conditions. After making changes to your circuit, you can rerun your scripts. OCEAN lets you

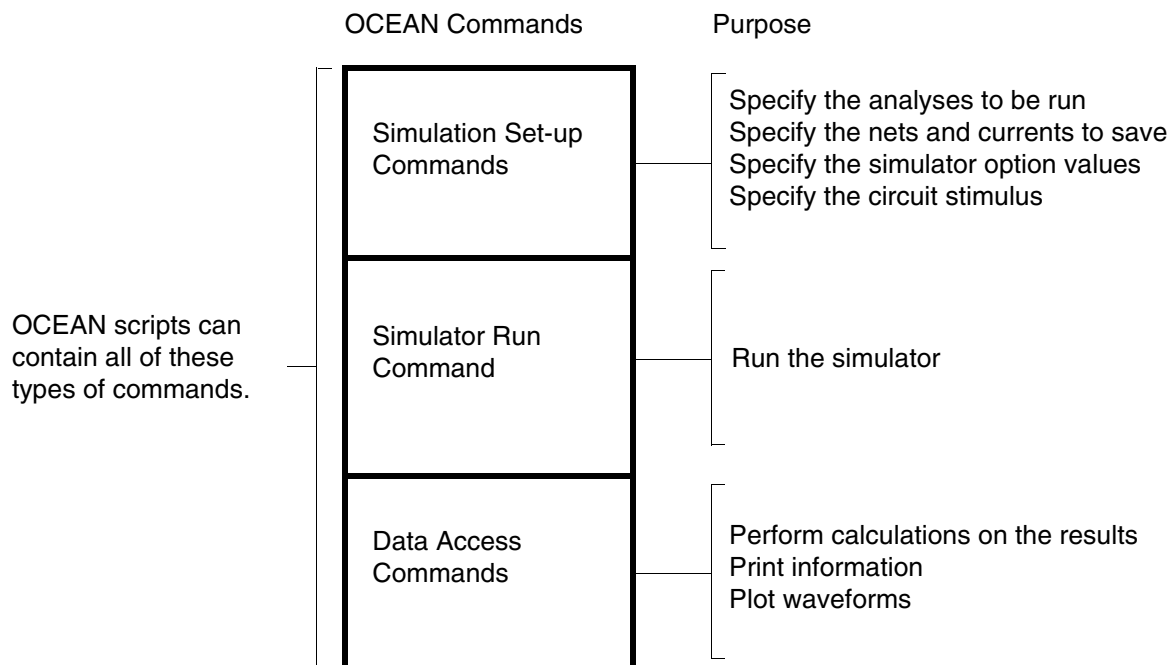
- Create scripts that you can run repeatedly to verify circuit performance
- Run longer analyses such as parametric analyses and statistical analyses more effectively
- Run long simulations in OCEAN without starting the Virtuoso® Analog Design Environment graphical user interface
- Run simulations from a nongraphic, remote terminal

Licensing Requirements

You must have the `Analog_Design_Environment_L` licence to use OCEAN. For information on licensing, see *[Virtuoso Software Licensing and Configuration Guide](#)*.

Types of OCEAN Commands

You can create OCEAN scripts to accomplish the full suite of simulation and data access tasks that you can perform in the Virtuoso® Analog Design Environment. An OCEAN script can contain three types of commands, as shown in the following figure:



All the parameter storage format (PSF) information created by the simulator is accessible through the OCEAN data access commands. (The data access commands include all of the Virtuoso® Analog Design Environment calculator functions.)

You can use the `history` command to view the command history from the current session and the most recently terminated session.

OCEAN Online Help

Online help is available for all the OCEAN commands when you are in an OCEAN session. To get help for a specific OCEAN command, type the following:

```
ocnHelp( 'commandName' )
```

This command returns an explanation of the command and examples of how the command can be used.

To get a listing of all the different types of commands in OCEAN, type the following:

```
ocnHelp()
```

For more information, see [“ocnHelp”](#) on page 174.

OCEAN Syntax Overview

OCEAN is based on the Virtuoso® SKILL programming language and uses SKILL syntax. All the SKILL language commands can be used in OCEAN. This includes `if` statements, `case` statements, `for` loops, `while` loops, `read` commands, `print` commands, and so on.

The most commonly used SKILL commands are documented in this manual. However, you are not limited to these commands. You can use any SKILL routine from any SKILL manual.

Common SKILL Syntax Characters Used in OCEAN

This section provides an overview of some basic SKILL syntax concepts that you need to understand to use OCEAN. For more information about SKILL syntax, see [Introduction to SKILL](#).

Parentheses

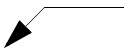
Parentheses surround the arguments to the command. The command name is followed immediately by the left parenthesis, with no intervening space.

Examples

The following example shows parentheses correctly enclosing two arguments to the `path` command.

```
path( "~/simulation1/schematic/psf" "~/simulation2/schematic/psf" )
```

In the next example, the space after the command name causes a syntax error.

 Syntax error.

```
path ( "~/simulation1/schematic/psf" "~/simulation2/schematic/psf" )
```

Quotation Marks

Quotation Marks are used to surround string values. A string value is a sequence of characters, such as `"abc"`.

In the following example, the directory names provided to the `path` command are strings, which must be surrounded by quotation marks.

```
path( "~/simulation1/schematic/psf" "~/simulation2/schematic/psf" )
```

Convention

In this manual, a SKILL convention is used to let you know when an argument must be a string. When you see the prefix `t_`, you must substitute a string value (surrounded by quotation marks) for the argument. Consider the following syntax statement:

```
desVar( t_desVar1 g_value1 t_desVar2 g_value2 )
```

In this case, there are two string values that must be supplied: `t_desVar1` and `t_desVar2`. (The `g_` prefix indicates a different type of argument. For more information about prefixes, see [Working with SKILL](#).)

Recovering from an Omitted Quotation Mark

Accidentally omitting a closing quotation mark from an OCEAN command can cause great confusion. For example, typing the incorrect command

```
strcat( "rain" "bow )
```

appears to hang OCEAN. In an attempt to recover, you type a `Control-c`. That gives you a prompt but it does not fix the problem, as you discover when you then type the correct command.

```
strcat( "rain" "bow" )
```

Again, you have to type a `Control-c` and OCEAN responds with another message.

```
^C*Error* parser: interrupted while reading input
```

If you find yourself in this situation, do not press a `Control-c`. Instead, recover by entering a quotation mark followed by a right square bracket (`]`). This procedure reestablishes a normal OCEAN environment and you can then reenter the correct command.

```
ocean> strcat( "rain" "bow" )
"]
"rainbow ) "
ocean> strcat( "rain" "bow" )
"rainbow"
ocean>
```

Single Quotation Marks

The single quotation mark indicates that an item is a symbol. Symbols in SKILL correspond to constant enums in C. In the context of OCEAN, there are predefined symbols. The simulator that you use also has predefined symbols. When using symbols in OCEAN, you must use these predefined symbols.

Examples

In the following example, `tran` is a symbol and must be preceded by a single quotation mark. The symbol `tran` is predefined. You can determine what the valid symbols for a command are by checking the valid values for the command's arguments. For example, if you refer to [“analysis”](#) on page 83, you see that the valid values for the first argument include `'tran`.

```
analysis( 'tran ... )
```

The list of items you can save with the `save` command is also predefined. You must choose from this predefined list. See [“save”](#) on page 144 and refer to the valid values for the `s_saveType` argument. The `'v` symbol indicates that the item to be saved is the voltage on a net.

```
save( 'v "net1" )
```

Convention

In this manual, a SKILL convention is used to let you know when an argument must be a symbol. When you see the prefix *s_*, you must substitute a symbol (preceded by a single quotation mark) for the argument. Consider the following syntax statement:

```
selectResults( s_resultsName ) => t / nil
```

In this case, there is one symbol that must be supplied: *s_resultsName*. For the `selectResults` command, there is a different mechanism that lets you know the list of predefined symbols. If you type the following command, with no arguments, the list of predefined symbols is returned: `results() => (dc tran ac)`

Note: Depending on which results are selected, the values returned by the `results` command vary.

Question Mark

The question mark indicates an optional keyword argument, which is the first part of a keyword parameter. A keyword parameter has two components:

- The first component is the keyword, which has a question mark in front of it.
- The second component is the value being passed, which immediately follows the keyword.

Keyword parameters, composed of these keyword/value pairs, are always optional.

Examples

In the following example, all the arguments to the `analysis` command except `'tran` are keyword/value pairs and are optional.

Keyword	Value passed
↓	↓

```
analysis( 'tran ?start 0 ?stop 1u ?step 1n )
```

For example, you can use `?center` and `?span` instead of `?start` and `?stop`. You also can omit `?start` altogether because it is an optional argument.

Convention

In this manual, a SKILL convention is used to let you know when arguments are optional. Optional arguments are surrounded by square brackets []. In the following example, all of the keyword/value pairs are surrounded by square brackets, indicating that they are optional.

```
report([?output t_filename | p_port] [?type t_type] [?name t_name] [?param  
      t_param] [?format s_reportStyle] ) => t / nil
```

Data Types Used in OCEAN

The following table shows the internal names and prefixes for the SKILL data types that are used in OCEAN commands.

Data Type	Internal Name	Prefix
floating-point number	flonum	f
any data type	general	g
linked list	list	l
integer, floating-point number, or complex number		n
user-defined type		o
I/O port	port	p
symbol	symbol	s
symbol or character string		S
character string (text)	string	t
window type		w
integer number	fixnum	x

For more information about SKILL datatypes, see [Chapter 4, “Working with SKILL.”](#)

OCEAN Return Values

You get return values from most OCEAN commands and can use these values in other OCEAN commands.

The following table shows some examples in which the return value from a command is assigned to a variable.

Assigning a Return Value to a Variable	Resulting Value for the Variable
<code>a=desVar("r1" 1k)</code>	<code>a=1k</code>
<code>a=desVar("r1" 1k "r2" 2k)</code>	<code>a=2k</code>
<code>a=desVar("r1")</code>	<code>a=1k</code> , assuming <code>r1</code> was set in a <code>desVar</code> command
<code>a=desVar("r2")</code>	<code>a=2k</code> , assuming <code>r2</code> was set in a <code>desVar</code> command

Design Variables in OCEAN

Design variables in OCEAN function as they do in the Virtuoso® Analog Design Environment. Design variables are not assigned in the order specified. Rather, they are reordered and then assigned. Consider the following example:

```
desVar( "a" "b+1" )
desVar( "b" 1 )
```

You might expect an error because `a` is assigned the value `b+1` before `b` is assigned a value. However, OCEAN reorders the statements and sends them as follows:

```
desVar( "b" 1 )
desVar( "a" "b+1" )
```

After the reordering, there is no error. (`b` is equal to 1 and `a` is equal to 2.)

Suppose you run a simulation, then specify the following:

```
desVar("b" 2)
```

You might expect `a` to be equal to 2, which was the last value specified. Instead, `a` is reevaluated to `b+1` or 3.

This approach is similar to how the design variables are used in simulation. For example, consider a circuit that has the following resistor:

```
R1 1 0 resistor r=b
```

If you change the value of `b`, you expect the value of `R1` to change. You do not expect to have to netlist again or retype the `R1` instantiation.

This approach is used in the Virtuoso® Analog Design Environment. Users are not expected to enter design variables in a particular order. Rather, the design variables are gathered during the design variable search then reordered before they are used.

You can also use a conditional expression containing the ternary operator (`? :`) to specify the value of a design variable, as shown below:

```
desVar( "b" 1 )
desVar( "a" "((b>1)?1:0)" )
```

Note: Do not use simulator reserved words as design variable names. For more information, see the [Reserved Words](#) section in the *Virtuoso Analog Design Environment User Guide*.

outputs() in OCEAN

Throughout this manual are examples of nets and instances preceded by a `"/` as well as examples without the `"/`. There is a significant difference between the two.

If you create a design in the Virtuoso® Analog Design Environment and save the OCEAN file, all net and instance names will be preceded with a `"/`, indicating they are schematic names. The `netlist/amap` directory must be available to map these schematic names to names the simulator understands. (If your design command points to the raw netlist in the `netlist` directory, the `amap` directory is there.)

If you create a design or an OCEAN script by hand, or move the raw netlist from the `netlist` directory, the net and instance names might not be preceded with `"/`. This indicates that simulator names are used, and mapping is not necessary.

If you are unsure whether schematic names or simulator names are used, after `selectResult($_resultsName), type outputs()` to see the list of net and instance names.

Note: Although you can move the raw netlist file from the `netlist` directory, it is not advised. There are other files in the `netlist` directory that are now required to run OCEAN.

Parametric Analysis

There are two ways you can run parametric analyses in OCEAN:

- You can use the `paramAnalysis` command (recommended approach).
- You can use a `SKILL for` loop.

Using the `paramAnalysis` command is an easier approach. With this command, you can set up any number of nested parametric analyses in an OCEAN script. The `paramRun` command runs all the parametric analyses. When the analysis is complete, the data can be plotted as a family of curves. The following example shows how you might use nested parametric analyses:

```
paramAnalysis( "r1" ?start 200 ?stop 600 ?step 200
    paramAnalysis( 'rs ?start 300 ?stop 700 ?step 200
        )
    )
paramRun ()
```

In this example, the outer loop cycles through `r1`, and the inner loop cycles through `rs` as follows:

Loop through `r1` from 200 to 600 by 200.

Loop through `rs` from 300 to 700 by 200.

Run.

End the first loop.

End the second loop.

So, for `r1=200`, `rs` equals 300, 500 and then 700. Then, for `r1=400`, `rs` equals 300, 500, and then 700. Finally, for `r1=600`, `rs` equals 300, 500, and then 700

Use a `SKILL` `for` loop only if the `paramAnalysis` command is not adequate. You can use the `SKILL` `for` loop to set up any number of variable-switching runs. After all the simulations are complete, you have to work with the results directories individually. The following example shows how you might use `SKILL` loops for parametric analyses.

```
Cload = list( 2p 4p 6p 8p )
foreach( val Cload
    desVar( "Cload" val )
    a=resultsDir( sprintf( nil "../demo/Cload=%g" val ) )
    printf( "%L", a )
    run( )
)
foreach( val Cload
    openResults( sprintf( nil "../<dir>/Cload=%g" val ) )
    selectResults( 'ac )
    plot( vdb( "vout" ) )
)
```

Data Access Without Running a Simulation

You can retrieve and use data from previous simulations at any time by opening the data with the `openResults` command. After opening the data, you can use any data access commands on this data. For more information, see [Chapter 7, “Data Access Commands.”](#)

You can use query commands such as `results`, `outputs`, and `dataTypes` to see what data is available to be opened.

Distributed Processing

You can use OCEAN distributed processing commands to run simulations across a collection of computer systems. The distributed processing commands allow you to specify where and when jobs are run and allow you to monitor and control jobs in a variety of ways. Using distributed commands, you can

- Submit one or more jobs to a distributed processing queue
- Specify a host or group of hosts on which to distribute jobs
- View the status of jobs
- Specify when a job will run or in what sequence a group of jobs will run
- Suspend and resume jobs
- Cancel jobs

For you to be able to use the distributed processing commands, your site administrator needs to set up the lists of machines to which jobs are submitted. Each list of machines is a group of hosts and is called a queue. Consult the [*Virtuoso Analog Distributed Processing Option User Guide*](#) for more information on how to configure systems for distributed processing. For information on the distributed processing commands for OCEAN, see [Chapter 12, “OCEAN Distributed Processing Commands.”](#)

Blocking and Nonblocking Modes

You can configure jobs to run in blocking or nonblocking mode. In blocking mode, execution of subsequent OCEAN commands is halted until the job completes. In nonblocking mode, the system does not wait for the first job to finish before starting subsequent jobs.

Blocking Mode

You must run jobs in blocking mode to be able to use the data resulting from a job in a subsequent command in an OCEAN script or batch run.

For example, if you want to run a simulation, select the `tran` results from that simulation, and then plot them, you

1. Configure the simulation with setup commands
2. Run the simulation with the `run()` command
3. Select the desired results with the `selectResults('tran')` command
4. Plot the results with the `plot()` command

A job like the one in the example above must run in blocking mode so that the commands are processed sequentially. If the jobs in the example above are run in nonblocking mode, the `selectResult` command starts before the `run` command can return any data, and the `selectResult` command and the `plot` command cannot complete successfully.

Nonblocking Mode

If you are submitting several jobs that have no interdependencies, you can run them concurrently when `hostmode` is set to `distributed`.

For example, if you want to run two separate simulations as jobs, but do not want to wait until the first is complete before starting the second, you

1. Configure the first simulation with setup commands
2. Configure a second simulation with setup commands

In the example above, the script starts the first job and then starts the second job without waiting for the first job to finish.

If you are running several commands, and some of them are data access commands, you can use the `wait` command to block a single job. The `wait` command is needed between the simulation and the data access commands to ensure the desired simulation is complete before the data is accessed.

For example, if you want to run two separate simulations as jobs (`sim1` and `sim2`), and want to select and plot the results of the second simulation run, you

1. Configure the first simulation with setup commands
2. Run the simulation with a `run(?jobPrefix "sim1")` command

3. Configure a second simulation with setup commands
4. Run the second simulation with the `run(?jobPrefix "sim2)` command
5. Cause the script to wait until the second simulation finishes before starting the `selectResults` command with the `wait(sim2)` command
6. Select the desired results with the `selectResults('tran)` command
7. Plot the results with the `plot()` command

In the example above, the script starts the first job and then starts the second job without waiting for the first job to finish. When the script reaches the `wait` command, it pauses until the second simulation runs and then selects the results to plot.

Plotting Simulation Results

The simulation results can be plotted in Virtuoso Visualization and Analysis XL, which is supported in the OCEAN environment.

OCEAN Reference

Introduction to OCEAN

Using OCEAN

This chapter explains the different ways you can use OCEAN to perform simulation tasks. In this chapter, you can find information about

- [OCEAN Use Models](#)
- [Using OCEAN Interactively](#)
- [License Requirements](#)
- [Creating OCEAN Scripts](#)
- [Selecting Results](#)
- [Running Multiple Simulators](#)
- [OCEAN Tips](#)

OCEAN Use Models

There are two ways you can use OCEAN:

- You can use OCEAN interactively to perform simple tasks.
- You can use OCEAN in batch mode and provide the name of an existing (or parameterized) script as a command line argument. OCEAN scripts can be created:
 - From the Virtuoso® Analog Design Environment window with the command *Session – Save Script*
 - Using a text editor

For information about creating scripts, see [“Creating OCEAN Scripts”](#) on page 37.

All the OCEAN commands are described in this manual, and online help is available for all these commands. For information about using the OCEAN online help, see [“OCEAN Online Help”](#) on page 19.

Note: The current version of OCEAN has some specific issues that are addressed in [Appendix 15, “OCEAN 4.4.6 Issues.”](#) Refer this appendix before using OCEAN.

Using OCEAN Interactively

You can run OCEAN from a UNIX prompt or from the Virtuoso® design framework II (DFII) Command Interpreter Window (CIW).

Note: The primary use model is to use OCEAN in a UNIX shell. Unless otherwise indicated, the rest of this chapter assumes that you are working from OCEAN in a UNIX shell.

Using OCEAN from a UNIX Shell

To start OCEAN from a UNIX prompt, type the following command:

```
ocean
```

This command loads and reads the `.oceanrc` file. You can place OCEAN commands in your `.oceanrc` file, which is similar to the `.cdsinit` file. This file can contain any valid OCEAN command, function or SKILL initialization routine (excluding graphical dfll references, such as bindkeys and so on, which are not applicable to OCEAN). If you do not want to specify any startup initialization options for OCEAN, you do not need to create or add an `.oceanrc` file.

The OCEAN prompt appears indicating that you have started OCEAN:

```
ocean>
```

If you do not see this prompt after starting OCEAN, press `Return`. If you still do not see this prompt, you may have redefined the prompt with the `setPrompt` command. (This does not affect OCEAN; the prompt just will not indicate OCEAN is running.)

Now you can start typing OCEAN commands interactively. For an example of interactive use, see [“Interactive Session Demonstrating the OCEAN Use Model”](#) on page 35.

To quit the OCEAN executable from UNIX, type the following command:

```
exit
```

OCEAN in Non-Graphical Mode

OCEAN is an executable shell script that calls the AWD workbench and passes all its command-line options to it using the following shell command:

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Using OCEAN

```
#!/bin/sh -
```

```
exec awd -ocean "$@"
```

This makes OCEAN highly dependent on the UNIX shell environment.

You can run OCEAN in a non-graphical mode by using the `-nograph` option with the `ocean` command. This disables the graphical options of the software. This option is useful if OCEAN is started on a machine that does not have X-Windows running.

Note: You can use the `-nograph` option to run the OCEAN job through a cron. Ensure that `DISPLAY` is set to `":0"`. If the screen will be locked when the OCEAN cron job runs, use the `allowaccess` option with the `xlock` command on the UNIX prompt. For more information on the usage of `xlock`, type `man xlock` in a terminal window.

The `-nograph` option must only be used to replay logfiles that have been created interactively. For example, while using OCEAN with the `-nograph` option, your `oceanScript.ocn` file must have an `exit()` statement at the end followed by a newline. Otherwise, OCEAN hangs. The reason for this is that when the workbench is started in the non-graphical mode, it does not redirect standard I/O as it normally does; instead, it lets the SKILL human interface (HI) handle the standard I/O. HI expects an explicit `exit()` statement at the end of the OCEAN script and OCEAN exits only when it detects an `exit()` at EOF. The command is used as follows:

```
ocean -nograph < oceanScript.ocn > oceanScript.log
```

Alternatively, you can execute the OCEAN script using the `-replay` option. The command is used as follows:

```
ocean -nograph -replay oceanScript.ocn -log oceanScript.log
```

`.oceanrc` is automatically loaded while using `ocean -nograph -replay` command. If you use the `virtuoso` command, `.oceanrc` is not loaded automatically.

While using the `-nograph` option with `ocean`, if you find that simulation run messages are not being stored in the log file, check for the following environment variable in the `.cdsenv` file:

```
(envGetVal "spectre.envOpts" "firstRun" )
```

It must be set to `nil` as shown below for simulation run messages to be stored in it:

```
(envSetVal "spectre.envOpts" "firstRun" 'boolean nil)
```

For more information about this variable, see Appendix B of the *Virtuoso Analog Design Environment L User Guide*.

Using OCEAN from the CIW

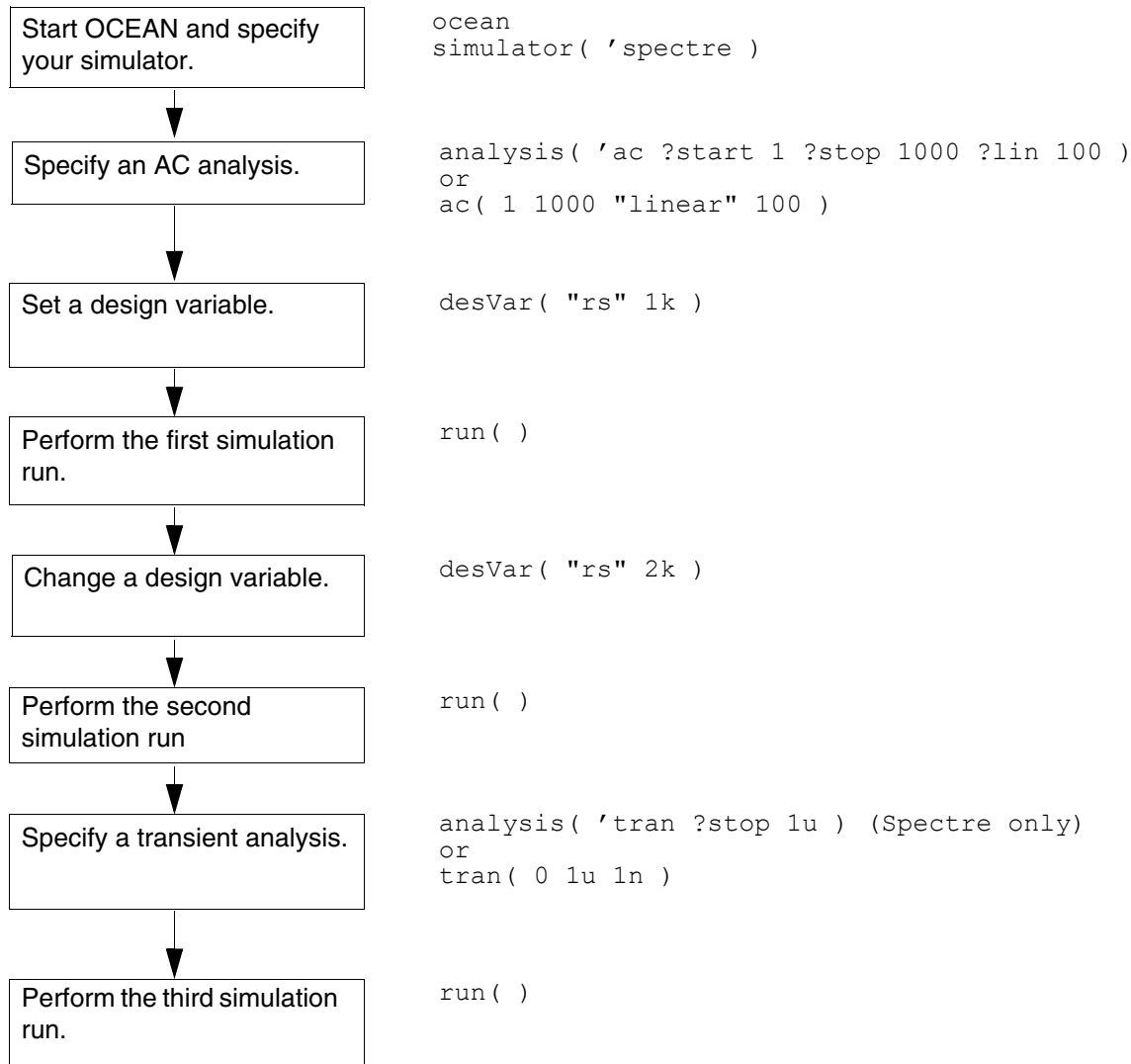
You can type OCEAN commands in the CIW after you bring up the Virtuoso® Analog Design Environment. (Starting the design environment loads the required OCEAN files.)

Your `.oceanrc` file is *not* automatically read when you start the DFII software (using the `virtuoso` command). Therefore, you might want to load your `.oceanrc` file manually in the CIW if you need information that it contains.

You can also use the `history` command from the CIW to list and reuse the most recently used commands.

Interactive Session Demonstrating the OCEAN Use Model

The following figure shows a typical set of simulation tasks that you might perform interactively in OCEAN with the corresponding commands.



On the second and third run, the AC analysis runs because it is still active. If you do not want it to run, you must disable it with the following command:

```
delete( 'analysis 'ac )
```

The simulator is not called and run until the `run()` command is entered.

The commands can be given in any order, as long as they are all defined before the `run()` command.

License Requirements

You need licenses to run the `simulator()` and `ocnSetXLMode()` OCEAN commands. For more information on these commands, see [simulator](#).

- To run the `simulator()` OCEAN command, you must have one of the following licenses. If one of these licenses are not already checked out, the first available license will be checked out in the following order:
 - ❑ 95200 Virtuoso(R) Analog Design Environment L
 - ❑ 95210 Virtuoso(R) Analog Design Environment XL
 - ❑ 95220 Virtuoso(R) Analog Design Environment GXL
- To run the `ocnSetXLMode()` OCEAN command, you must have one of the following licenses. If one of these licenses are not already checked out, the first available license will be checked out in the following order:
 - ❑ 95210 Virtuoso(R) Analog Design Environment XL
 - ❑ 95220 Virtuoso(R) Analog Design Environment GXL

Note the following:

- ❑ If you have run the `ocnSetXLMode()` command, running the `simulator()` command subsequently will not checkout an additional license.
- ❑ While working with the ICADVM20.1 release version, use the `ocnSetXLMode("explorer")` or `ocnSetXLMode("assembler")` command to check out the ADE Explorer or ADE Assembler license respectively since support for ADE XL has been removed in this release version.

If you do not want OCEAN to automatically checkout a higher tiered license—for example, if you do not want OCEAN to automatically checkout the 95210 license if the 95200 license is not available—set the following environment variable in your `.cdsenv` file:

```
asimenv.misc  alwaysTryHigherTieredLicenseInOcean  'boolean nil
```

Note: If the `alwaysTryHigherTieredLicenseInOcean` environment variable is set to `nil`, errors are displayed if OCEAN is unable to checkout a license.

Note: The 95200 Virtuoso(R) Analog Design Environment L license is checked out when you load the ocean script. Exit Virtuoso, or run the `ocnCloseSession()` command to release the license.

Creating OCEAN Scripts

You can modify the included sample script files or create script files interactively from the Virtuoso® Analog Design Environment.

Creating Scripts Using Sample Script Files

You can create your own script files with a text editor using the sample scripts as examples, or you can make copies of the sample scripts and modify them as needed using a text editor. The scripts can be found in the following directory:

`your_install_dir/tools/dfII/samples/artist/OCEAN`

Refer to the `README` file in this directory for information about the scripts.

Creating Scripts from the Analog Design Environment

When you perform tasks in the design environment, the associated OCEAN commands are automatically stored in the `simulatorx.ocn` file in your `netlist` directory. For example, if you start the Virtuoso software, open the Virtuoso® Analog Design Environment window, and run a simulation using the Cadence SPICE simulator, a `cdsSpice0.ocn` file is created in your `netlist` directory. You can load this `cdsSpice0.ocn` script as described in [“Loading OCEAN Scripts”](#) on page 40.

Selectively Creating Scripts

You can be selective about the information that is created in your `.ocn` script. The Virtuoso® Analog Design Environment has a feature that lets you create an OCEAN script based on the state of your current session. The following example illustrates how using this feature is different than using the automatic script generation feature.

Consider the following task flow:

1. Start the Virtuoso® Analog Design Environment.
2. Specify a DC analysis.
3. Select nets on the schematic to save.
4. Run the simulation.
5. Turn off the DC analysis.
6. Select a transient analysis.

7. Run the simulation.
8. Save the script from the Virtuoso® Analog Design Environment.

The script that is created, called `oceanScript.ocn` by default, contains only the selected nets, the transient analysis, and the run command. The script does not contain the DC analysis because it was turned off.

In contrast, the `simulator0.ocn` script, which is automatically created in the `netlist` directory, contains all of the commands, including the DC analysis and the current state of the analysis (on or off).

Creating a Script

To selectively create a script from Virtuoso Analog Design Environment L or ,

1. Start the Virtuoso software,

```
virtuoso
```

The CIW appears.

2. From the CIW, choose *Tools – ADE L – Simulation*.

The Virtuoso Analog Design Environment window appears.

3. Perform all of the design environment tasks that you want to capture in the script.

4. Choose *Session – Save Script*.

The Save Ocean Script to File form appears.

5. Click *OK* to accept the default file name (`./oceanScript.ocn`), or change the name for the file and click *OK*.

A script containing the OCEAN commands for the tasks you performed is created. For information about how to load this script, see [“Loading OCEAN Scripts”](#) on page 40.

Controlling What Is Included in Scripts

You can use `.cdsenv` variables to alter the OCEAN script that is created when you choose *Session – Create Script* in the Virtuoso Analog Design Environment. One variable allows you to include default environment settings in a script, two other variables allow you to run procedures before and after a script is created.

Including Default Control Statements

To save every control statement, including default statements, in your OCEAN script, add the following line to your `.cdsenv` file.

```
asimenv.misc saveDefaultsToOCEAN boolean t
```

Setting `saveDefaultsToOCEAN` to `t` results in a complete dump of the current circuit design environment, defaults and all. Because the created OCEAN script contains all the settings, you might use this variable when you plan to archive a script, for example.

If `saveDefaultsToOCEAN` is not set to `t`, the created OCEAN script contains only those items that you explicitly set to some value other than their default.

Running Functions Before or After Creating a Script

The information in this section describes how you can specify functions to be run before or after a script is created. You can use these functions, for example, to add information at the beginning or end of a script. To use this capability follow these steps.

1. Decide when you want the functions to run.

- ❑ Add the following line to your `.cdsenv` file to run the function `preOceanFunc` before the OCEAN script is created.

```
asimenv.misc preSaveOceanScript string "preOceanFunc"
```

- ❑ Add the following line to your `.cdsenv` file to run the function `postOceanFunc` after the OCEAN script is created.

```
asimenv.misc postSaveOceanScript string "postOceanFunc"
```

2. Use the following syntax to specify the functions.

```
preOceanFunc( session fp )  
postOceanFunc( session fp )
```

In this syntax, `session` is the OASIS session and `fp` is the file pointer to the OCEAN script file. For guidance on determining the `session` to use, see the [*VirtuosoAnalog Design Environment L SKILL Language Reference*](#).

3. Load the functions in your `.cdsinit` file.

For example, you might add the following lines to your `.cdsenv` file.

```
asimenv.misc preSaveOceanScript string "MYfirstProc"  
asimenv.misc postSaveOceanScript string "MYlastProc"
```

The functions `MYfirstProc` and `MYlastProc` might be defined like this.

```
procedure( MYfirstProc( session fp )  
    fprintf(fp "; This will be the first line in the ocean script.\n")  
)
```

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```
procedure( MYlastProc( session fp)
  fprintf(fp "; This will be the last line in the ocean script.\n")
)
```

If these procedures are defined in a file called `myOceanProcs.il`, you can load them by adding to your `.cdsinit` file a command like the following.

```
load "myOceanProcs.il"
```

When you choose *Session – Create Script*, first the `preSaveOceanScript` procedure is called, then the OCEAN script is created, then the `postSaveOceanScript` procedure is called.

Loading OCEAN Scripts

You can load OCEAN scripts from OCEAN (in UNIX) or from the CIW.

From a UNIX Shell

To load an OCEAN script,

1. Type the following command to start OCEAN:

```
ocean
```

The OCEAN prompt appears.

2. Use the SKILL `load` command to load your script:

```
load( "script_name.ocn" )
```

Messages about the progress of your script appear.

From the CIW

To load an OCEAN script,

1. Start the Virtuoso software

```
virtuoso &
```

The CIW appears.

2. In the text entry field, use the SKILL `load` command to load your script:

```
load( "script_name.ocn" )
```

Messages about the progress of your script appear in the CIW.

Selecting Results

You may use OCEAN to run several simulations on the same design and save the results in different result directories. You can then use Analog Design Environment XL to select the results and work with features like annotation etc.

Selecting Results Run from Worst Case Scripts for Cross-Probing or Back Annotating Operating Points

Assume that you have been using Ocean to create separate data directories for worst case parameter sweeps. Also, assume that the new directories you make are accessed with the `resultsDir()` ocean command in your Ocean script and that these directories are in the standard location where `psf` data is stored in the Analog Design Environment.

In the Analog Design Environment, `psf` data is stored in:

```
<runDir>/simulation/<testSchemName>/spectre/schematic/psf
```

where,

`runDir` is the directory where you invoke `virtuoso&`
`testSchemName` is your test schematic

This implies that your script should store the new directories under the `schematic` directory. Therefore, if `c1`, `c2` and `c3` are the worst case directories, they are located at:

```
<runDir>/simulation/<testSchemName>/spectre/schematic/c1  
<runDir>/simulation/<testSchemName>/spectre/schematic/c2  
<runDir>/simulation/<testSchemName>/spectre/schematic/c3
```

1. Choose *Results – Select*
2. The *Select Results* form opens. Click *Browse*. A Unix Browser form appears.
3. Navigate to the directory that contains your Ocean generated directories `c1`, `c2`, and `c3`.
4. Click *OK* on the Unix Browser form. Now the *Select Results* Form should show `c1`, `c2` and `c3`.
5. Double-click `c1`, `c2` or `c3`. Alternatively, you can also single-click `c1`, `c2` or `c3` and then choose *Update Results* and click *OK*. At this point the data is selected though there is no confirmation in the CIW. Now, you should be able to use *Results – Direct Plot*, *Results – Annotate* etc to see the results of that particular directory.

Selecting Results Run from Spectre Standalone

After running spectre standalone, you can select results using the *Results Browser* and use calculator to plot the results. However, this does not allow you to use ADE features like *Results – Direct Plot* or *Results – Annotate*.

Consider that your data is in

```
<runDir>/simulation/<testSchemName>/spectre/schematic/psf.
```

where,

runDir is the directory where you invoke virtuoso&
testSchemName is your test schematic

1. Choose *Tools – Results Browser*. A pop up box appears. Enter your design path up to the spectre directory.
2. Click *OK*, and the browser comes up.
3. Click the schematic directory. The psf directory should appear.
4. Click the directory with the data in it, psf. When you click the 'psf' directory you should see the tree expand with different results from your spectre stand alone simulation, e.g. tran.tran etc.
5. Place the mouse pointer over the 'psf' node in the tree and press down the middle mouse key and scroll down to "create ROF". You should now see the psf directory change, and an intermediate node comes up --Run1-- betweenpsf/ and the results.
6. Place the middle mouse pointer over the Run1 node, scroll down and select "Select Results".

Note: Even though there is a confirmation message in the CIW that the select was success, Analog Design Environment is not synced up to allow cross-probing and backannotation of operating points.

7. You may now use *Tools – Calculator* to select objects from the schematic. You can then choose 'plot' from the calculator, or different calculator operations.

Note: You CAN use *Tools – Calculator* but you CAN NOT use *Results – Direct Plot* or *Results – Annotate* etc.

Running Multiple Simulators

There are times when you might want to run more than one simulator. You might be benchmarking simulators or comparing results. In OCEAN, you can only use one simulator per OCEAN session. If you change simulators, you must start a new OCEAN session. This is because some OCEAN command arguments are simulator specific, and therefore change when the simulator changes. For example, the arguments to the `option` command are simulator specific. (No two simulators have the exact same options.) The analyses are typically simulator specific also.

OCEAN Tips

The information in this section can help you solve problems that you encounter while using OCEAN.

- While working in OCEAN, you might get the following SKILL error message:

```
*Error* eval: unbound variable - nameOfVariable
```

In this case, you need to see if you have an undeclared variable or if you are missing a single quotation mark (') or a quotation mark (") for one of your arguments. For example, the following command returns an error message stating that `fromVal` is an unbound variable because the variable has not been declared:

```
analysis('tran ?from fromVal)
```

However, the following pair of statements work correctly because `fromVal` has a value (is bound).

```
fromVal=0  
analysis('tran ?from fromVal)
```

- If you get an error in an OCEAN session, you are automatically put into the SKILL debugger. In this case, you see a prompt similar to this:

```
ocean-Debug 2>
```

You can continue working. However, if you would like to get out of the debugger, you can type

```
debugQuit()
```

Now you are back to the normal prompt:

```
ocean>
```

- If it appears that OCEAN does not accept your input, or OCEAN appears to hang, then you may have forgotten to enter a closing quotation mark. Type "] " to close all strings. For more information, and some examples, see [“Recovering from an Omitted Quotation Mark”](#) on page 20.

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Using OCEAN

- In SKILL, the following formats are equivalent: `(one two)` and `one(two)`. Results might be returned in either format. For example, OCEAN might return `ac(tran)` or `(ac tran)`, but the two forms are equivalent.
- You can check your script for simple syntax errors by running SKILL lint. For example, you might use a command like

```
sklint -file myScript.ocn
```

From within OCEAN, you can run SKILL lint by typing the following at the OCEAN prompt:

```
sklint(?file "yourOceanScript.ocn")
```

Running SKILL lint helps catch basic errors, such as unmatched parentheses and strings that are not closed.

Introduction to SKILL

This chapter introduces you to the basic concepts that can help you get started with the Virtuoso® SKILL programming language. In this chapter, you can find information about

- [The Advantages of SKILL](#)
- [Naming Conventions](#)
- [Arithmetic Operators](#)
- [Scaling Factors](#)
- [Relational and Logical Operators](#)
- [SKILL Syntax](#)
- [Arithmetic and Logical Expressions](#)

The Advantages of SKILL

The SKILL programming language lets you customize and extend your design environment. SKILL provides a safe, high-level programming environment that automatically handles many traditional system programming operations, such as memory management. SKILL programs can be immediately run in the Virtuoso environment.

SKILL is ideal for rapid prototyping. You can incrementally validate the steps of your algorithm before incorporating them in a larger program.

SKILL leverages your investment in Cadence technology because you can combine existing functionality and add new capabilities.

SKILL lets you access and control all the components of your tool environment: the User Interface Management System, the Design Database, and the commands of any integrated design tool. You can even loosely couple proprietary design tools as separate processes with SKILL's interprocess communication facilities.

Naming Conventions

The recommended naming scheme is to use uppercase and lowercase characters to separate your code from code developed by Cadence.

All code developed by Cadence Design Systems typically names global variables and functions with up to three lowercase characters, that signify the code package, and the name starting with an uppercase character. For example, `dmiPurgeVersions()` or `hnlCellOutputs`. All code developed outside Cadence should name global variables by starting them with an uppercase character, such as `AcmeGlobalForm`.

Arithmetic Operators

SKILL provides many arithmetic operators. Each operator corresponds to a SKILL function, as shown in the following table.

Sample SKILL Operators

Operators in Descending Precedence	Underlying Function
**	exponentiation
*	multiply
/	divide
+	plus
-	minus
==	equal
!=	nequal
=	assignment

Scaling Factors

SKILL provides a set of scaling factors that you can add to the end of a decimal number (integer or floating point) to achieve the scaling you want.

- Scaling factors must appear immediately after the numbers they affect. Spaces are not allowed between a number and its scaling factor.
- Only the first nonnumeric character that appears after a number is significant. Other characters following the scaling factor are ignored. For example, for the value 2.3mvolt, the *m* is significant, and the *volt* is discarded. In this case, *volt* is only for your reference.

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Introduction to SKILL

- If the number being scaled is an integer, SKILL tries to keep it an integer; the scaling factor must be representable as an integer (that is, the scaling factor is an integral multiplier and the result does not exceed the maximum value that can be represented as an integer). Otherwise, a floating-point number is returned.

The scaling factors are listed in the following table.

Scaling Factors

Character	Name	Multiplier	Examples
Y	Yotta	10^{24}	10Y [10e+25]
Z	Zetta	10^{21}	10Z [10e+22]
E	Exa	10^{18}	10E [10e+19]
P	Peta	10^{15}	10P [10e+16]
T	Tera	10^{12}	10T [1.0e13]
G	Giga	10^9	10G [10,000,000,000]
M	Mega	10^6	10M [10,000,000]
K	Kilo	10^3	10K [10,000]
%	percent	10^{-2}	5% [0.05]
m	milli	10^{-3}	5m [5.0e-3]
u	micro	10^{-6}	1.2u [1.2e-6]
n	nano	10^{-9}	1.2n [1.2e-9]
p	pico	10^{-12}	1.2p [1.2e-12]
f	femto	10^{-15}	1.2f [1.2e-15]
a	atto	10^{-18}	1.2a [1.2e-18]
z	zepto	10^{-21}	1.2z [1.2e-21]
y	yocto	10^{-24}	1.2y [1.2e-24]

Note: The characters used for scaling factors depend on your target simulator. For example, if you are using cdsSpice, the scaling factor for *M* is different than shown in the previous table, because cdsSpice is not case sensitive. In cdsSpice, *M* and *m* are both interpreted as 10^{-3} , so *ME* or *me* is used to signify 10^6 .

Relational and Logical Operators

This section introduces you to

- Relational Operators: <, <=, >, >=, ==, !=
- Logical Operators: !, &&, ||

Relational Operators

Use the following operators to compare data values. SKILL generates an error if the data types are inappropriate. These operators all return `t` or `nil`.

Sample Relational Operators

Operator	Arguments	Function	Example	Return Value
<	numeric	lessp	3 < 5	t
			3 < 2	nil
<=	numeric	leqp	3 <= 4	t
>	numeric	greaterp	5 > 3	t
>=	numeric	geqp	4 >= 3	t
==	numeric	equal	3.0 == 3	t
	string list		"abc" == "ABc"	nil
!=	numeric	nequal		
	string list		"abc" != "ABc"	t

Knowing the function name is helpful because error messages mention the function (`greaterp` below) instead of the operator (`>`).

```
1 > "abc"  
Message: *Error* greaterp: can't handle (1 > "abc")
```


Logical Operators

SKILL considers `nil` as FALSE and any other value as TRUE. The `and (&&)` and `or (||)` operators only evaluate their second argument if it is required for determining the return result.

Sample Logical Operators

Operator	Arguments	Function	Example	Return Value
&&	general	and	3 && 5	5
			5 && 3	3
			t && nil	nil
			nil && t	nil
	general	or	3 5	3
			5 3	5
			t nil	t
			nil t	t

The `&&` and `||` operators return the value last computed. Consequently, both `&&` and `||` operators can be used to avoid cumbersome `if` or `when` expressions.

The following example illustrates the difference between using `&&` and `||` operators and using `if` or `when` expressions.

You do not need to use

```
If (usingcolor then
currentcolor=getcolor( )
else
currentcolor=nil
)
```

Instead use

```
currentcolor=usingcolor && getcolor( )
```

Using &&

When SKILL creates a variable, it gives the variable a value of `unbound` to indicate that the variable has not been initialized yet. Use the `boundp` function to determine whether a variable is bound. The `boundp` function

- Returns `t` if the variable is bound to a value
- Returns `nil` if the variable is not bound to a value

Suppose you want to return the value of a variable `trMessages`. If `trMessages` is unbound, retrieving the value causes an error. Instead, use the expression

```
boundp( 'trMessages ) && trMessages
```

Using ||

Suppose you have a default name, such as `noName`, and a variable, such as `userName`. To use the default name if `userName` is `nil`, use the following expression:

```
userName || "noName"
```

SKILL Syntax

This section describes SKILL syntax, which includes the use of special characters, comments, spaces, parentheses, and other notation.

Special Characters

Certain characters are special in SKILL. These include the *infix* operators such as less than (<), colon (:), and assignment (=). The following table lists these special characters and their meaning in SKILL.

Note: All nonalphanumeric characters (other than `_` and `?`) must be preceded (*escaped*) by a backslash (`\`) when you use them in the name of a symbol.

Special Characters in SKILL

Character	Name	Meaning
<code>\</code>	backslash	Escape for special characters
<code>()</code>	parentheses	Grouping of list elements, function calls
<code>[]</code>	brackets	Array index, super right bracket
<code>'</code>	single quotation mark	Specifies a symbol (quoting the expression prevents its evaluation)
<code>"</code>	quotation mark	String delimiter
<code>,</code>	comma	Optional delimiter between list elements
<code>;</code>	semicolon	Line-style comment character

Special Characters in SKILL

Character	Name	Meaning
+, -, *, /	arithmetic	For arithmetic operators; the /* and */ combinations are also used as comment delimiters
!, ^, &,	logical	For logical operators
<, >, =	relational	For relational and assignment operators; < and > are also used in the specification of bit fields
?	question mark	If first character, implies keyword parameter
%	percent sign	Used as a scaling character for numbers

White Space

White space sometimes takes on semantic significance and a few syntactic restrictions must therefore be observed.

Write function calls so the name of a function is immediately followed by a left parenthesis; no white space is allowed between the function name and the parenthesis. For example

`f(a b c)` and `g()` are legal function calls, but `f (a b c)` and `g ()` are illegal.

The unary minus operator must immediately precede the expression it applies to. No white space is allowed between the operator and its operand. For example

`-1`, `-a`, and `-(a*b)` are legal constructs, but `- 1`, `- a`, and `- (a*b)` are illegal.

The binary minus (subtract) operator should either be surrounded by white space on both sides or be adjacent to non-white space on both sides. To avoid ambiguity, one or the other method should be used consistently. For example:

`a - b` and `a-b` are legal constructs for binary minus, but `a -b` is illegal.

Comments

SKILL permits two different styles of comments. One style is block oriented, where comments are delimited by /* and */. For example:

```
/* This is a block of (C style) comments
comment line 2
comment line 3 etc.
*/
```

The other style is line- oriented where the semicolon (;) indicates that the rest of the input line is a comment. For example:

```
x = 1           ; comment following a statement
; comment line 1
; comment line 2 and so forth
```

For simplicity, line-oriented comments are recommended. Block-oriented comments cannot be nested because the first */ encountered terminates the whole comment.

Role of Parentheses

Parentheses () delimit the names of functions from their argument lists and delimit nested expressions. In general, the innermost expression of a nested expression is evaluated first, returning a value used in turn to evaluate the expression enclosing it, and so on until the expression at the top level is evaluated. There is a subtle point about SKILL syntax that C programmers, in particular, must notice.

Parentheses in C

In C, the relational expression given to a conditional statement such as `if`, `while`, and `switch` must be enclosed by an outer set of parentheses for purely syntactical reasons, even if that expression consists of only a single Boolean variable. In C, an `if` statement might look like

```
if (done) i=0; else i=1;
```

Parentheses in SKILL

In SKILL, parentheses are used for specifying lists, calling functions, delimiting multiple expressions, and controlling the order of evaluation. You can write function calls in prefix notation

```
(fn2 arg1 arg2) or (fn0)
```

as well as in the more conventional algebraic form

```
fn2(arg1 arg2) or fn0()
```

The use of syntactically redundant parentheses causes variables, constants, or expressions to be interpreted as the names of functions that need to be further evaluated. Therefore,

- Never enclose a constant or a variable in parentheses by itself; for example, `(1)`, `(x)`.

- For arithmetic expressions involving *infix* operators, you can use as many parentheses as necessary to force a particular order of evaluation, but never put a pair of parentheses immediately outside another pair of parentheses; for example, `((a + b))`: the expression delimited by the inner pair of parentheses would be interpreted as the name of a function.

For example, because `if` evaluates its first argument as a logical expression, a variable containing the logical condition to be tested should be written without any surrounding parentheses; the variable by itself is the logical expression. This is written in SKILL as

```
if( done then i = 0 else i = 1)
```

Line Continuation

SKILL places no restrictions on how many characters can be placed on an input line, even though SKILL does impose an 8,191 character limit on the strings being entered. The parser reads as many lines as needed from the input until it has read in a complete form (that is, expression). If there are parentheses that have not yet been closed or binary *infix* operators whose right sides have not yet been given, the parser treats carriage returns (that is, newlines) just like spaces.

Because SKILL reads its input on a form-by-form basis, it is rarely necessary to “continue” an input line. There might be times, however, when you want to break up a long line for aesthetic reasons. In that case, you can tell the parser to ignore a carriage return in the input line, by preceding it immediately with a backslash (`\`).

```
string = "This is \  
a test."  
=> "This is a test."
```

Arithmetic and Logical Expressions

Expressions are SKILL objects that also evaluate to SKILL objects. SKILL performs a computation as a sequence of function evaluations. A SKILL *program* is a sequence of expressions that perform a specified action when evaluated by the SKILL interpreter.

There are two types of primitive expressions in SKILL that pertain to OCEAN: constants and variables.

Constants

A *constant* is an expression that evaluates to itself. That is, evaluating a constant returns the constant itself. Examples of constants are `123`, `10.5`, and `"abc"`.

Variables

A *variable* stores values used during the computation. The variable returns its value when evaluated. Examples of variables are `a`, `x`, and `init_var`.

When the interpreter evaluates a variable whose value has not been initialized, it displays an error message telling you that you have an unbound variable. For example, you get an error message when you misspell a variable because the misspelling creates a new variable.

```
myVariable
```

causes an error message because it has been referenced before being assigned, whereas

```
myVariable = 5
```

works.

When SKILL creates a variable, it gives the variable an initial value of `unbound`. It is an error to evaluate a variable with this value because the meaning of `unbound` is *that-value-which-represents-no-value*. `unbound` is not the same as `nil`.

Using Variables

You do not need to declare variables in SKILL as you do in C. SKILL creates a variable the first time it encounters the variable in a session. Variable names can contain

- Alphanumeric characters
- Underscores (`_`)
- Question marks
- Digits

The first character of a variable must be an alphanumeric character or an underscore. Use the assignment operator to store a value in a variable. You enter the variable name to retrieve its value.

```
lineCount = 4           => 4
lineCount              => 4
lineCount = "abc"       => "abc"
lineCount              => "abc"
```

Creating Arithmetic and Logical Expressions

Constants, variables, and function calls can be combined with the *infix* operators, such as less than (`<`), colon (`:`), and greater than (`>`) to form arithmetic and logical expressions. For example: `1+2`, `a*b+c`, `x>y`.

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You can form arbitrarily complicated expressions by combining any number of the primitive expressions described above.

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Introduction to SKILL

Working with SKILL

This chapter provides information on using SKILL functions. It includes information on the types of SKILL functions, the types of data accepted as arguments, how data types are used, and how to declare and define functions. In this chapter, you can find information about

- [SKILL Functions](#)
- [Data Types](#)
- [Arrays](#)
- [Concatenating Strings \(Lists\)](#)
- [Declaring a SKILL Function](#)
- [SKILL Function Return Values](#)
- [Syntax Functions for Defining Functions](#)

SKILL Functions

There are two basic types of SKILL functions:

- *Functions* carry out statements and return data that can be redirected to other commands or functions.
- *Commands* are functions that carry out statements defined by the command and return `t` or `nil`. Some commands return the last argument entered, but the output cannot be redirected.

Data Types

SKILL supports several data types, including integer and floating-point numbers, character strings, arrays, and a highly flexible linked list structure for representing aggregates of data. The simplest SKILL expression is a single piece of data, such as an integer, a floating-point

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Working with SKILL

number, or a string. SKILL data is case sensitive. You can enter data in many familiar ways, including the following:

Sample SKILL Data Items

Data Type	Syntax Example
integer	5
floating point number	5.3
text string	"Mary had a little lamb"

For symbolic computation, SKILL has data types for dealing with symbols and functions.

For input/output, SKILL has a data type for representing I/O ports. The table below lists the data types supported by SKILL with their internal names and prefixes.

Data Types Supported by SKILL

Data Type	Internal Name	Prefix
array	array	a
boolean		b
floating-point number	flonum	f
any data type	general	g
linked list	list	l
floating-point number or integer		n
user-defined type		o
I/O port	port	p
symbol	symbol	s
symbol or character string		S
character string (text)	string	t
window type		w
integer number	fixnum	x

Numbers

SKILL supports the following numeric data types:

- Integers
- Floating-point

Both integers and floating-point numbers may use scaling factors to scale their values. For information on scaling factors, see [“Scaling Factors”](#) on page 46.

Atoms

An *atom* is any data object that is not a grouping or collection of other data objects. Built into SKILL are several special atoms that are fundamental to the language.

<code>nil</code>	The <code>nil</code> atom represents both a false logical condition and an empty list.
<code>t</code>	The symbol <code>t</code> represents a true logical condition.

Both `nil` and `t` always evaluate to themselves and must never be used as the name of a variable.

<code>unbound</code>	To make sure you do not use the value of an uninitialized variable, SKILL sets the value of all symbols and array elements initially to <code>unbound</code> so that such an error can be detected.
----------------------	---

Constants and Variables

Supported constants and variables are discussed in [“Arithmetic and Logical Expressions”](#) on page 3-14.

Strings

Strings are sequences of characters; for example, `"abc"` or `"123"`. A string is marked off by quotation marks, just as in the C language; the empty string is represented as `" "`. The SKILL parser limits the length of input strings to a maximum of 8,191 characters. There is, however, no limit to the length of strings created during program execution. Strings of more than 8,191 characters can be created by applications and used in SKILL if they are not given as arguments to SKILL string manipulation functions.

When typing strings, you specify

- Printable characters (except a quotation mark) as part of a string without preceding them with the backslash (\) escape character
- Unprintable characters and the quotation mark itself by preceding them with the backslash (\) escape character, as in the C language

Arrays

An *array* represents aggregate data objects in SKILL. Unlike simple data types, you must explicitly create arrays before using them so the necessary storage can be allocated. SKILL arrays allow efficient random indexing into a data structure using familiar syntax.

- Arrays are not typed. Elements of the same array can be different data types.
- SKILL provides run-time array bounds checking. The array bounds are checked with each array access during runtime. An error occurs if the index is outside the array bounds.
- Arrays are one dimensional. You can implement higher dimensional arrays using single dimensional arrays. You can create an array of arrays.

Allocating an Array of a Given Size

Use the `declare` function to allocate an array of a given size.

```
declare( week[7] )           => array[7]:9780700
week                         => array[7]:9780700
type( week )                 => array
days = ' (monday tuesday wednesday
          thursday friday saturday sunday)
for( day 0 length(week)-1
    week[day] = nth(day days))
```

- The `declare` function returns the reference to the array storage and stores it as the value of `week`.
- The `type` function returns the symbol *array*.

Concatenating Strings (Lists)

Concatenating a List of Strings with Separation Characters (`buildString`)

`buildString` makes a single string from the list of strings. You specify the separation character in the third argument. A null string is permitted. If this argument is omitted, `buildString` provides a separating space as the default.

```
buildString( ' ("test" "il") "." )      => "test.il"
buildString( ' ("usr" "mnt") "/" )      => "usr/mnt"
buildString( ' ("a" "b" "c") )          => "a b c"
buildString( ' ("a" "b" "c") "" )       => "abc"
```

Concatenating Two or More Input Strings (`strcat`)

`strcat` creates a new string by concatenating two or more input strings. The input strings are left unchanged.

```
strcat( "l" "ab" "ef" )      => "labef"
```

You are responsible for any separating space.

```
strcat( "a" "b" "c" "d" )    => "abcd"
strcat( "a " "b " "c " "d " ) => "a b c d "
```

Appending a Maximum Number of Characters from Two Input Strings (`strncat`)

`strncat` is similar to `strcat` except that the third argument indicates the maximum number of characters from *string2* to append to *string1* to create a new string. *string1* and *string2* are left unchanged.

```
strncat( "abcd" "efghi" 2)      => "abcdef"
strncat( "abcd" "efghijk" 5)    => "abcdefghi"
```

Comparing Strings

Comparing Two Strings or Symbol Names Alphabetically (`alphalessp`)

`alphalessp` compares two objects, which must be either a string or a symbol, and returns `t` if *arg1* is alphabetically less than *arg2*. `alphalessp` can be used with the `sort` function to sort a list of strings alphabetically. For example:

```
stringList = ' ( "xyz" "abc" "ghi" )
sort( stringList 'alphalessp ) => ("abc" "ghi" "xyz")
```

The next example returns a sorted list of all the files in the login directory:

```
sort( getDirFiles( "~" ) 'alphalessp )
```

Comparing Two Strings Alphabetically (strcmp)

`strcmp` compares two strings. (To test if two strings are equal or not, you can use the `equal` command.) The return values for `strcmp` are explained in the following table.

Return Value	Meaning
1	<i>string1</i> is alphabetically greater than <i>string2</i> .
0	<i>string1</i> is alphabetically equal to <i>string2</i> .
-1	<i>string1</i> is alphabetically less than <i>string2</i> .

```
strcmp( "abc" "abb" )=> 1  
strcmp( "abc" "abc")=> 0  
strcmp( "abc" "abd")=> -1
```

Comparing Two String or Symbol Names Alphanumerically or Numerically (alphaNumCmp)

`alphaNumCmp` compares two string or symbol names. If the third optional argument is not `nil` and the first two arguments are strings holding purely numeric values, a numeric comparison is performed on the numeric representation of the strings. The return values are explained in the following table.

Return Value	Meaning
1	<i>arg1</i> is alphanumerically greater than <i>arg2</i> .
0	<i>arg1</i> is alphanumerically identical to <i>arg2</i> .
-1	<i>arg2</i> is alphanumerically greater than <i>arg1</i> .

Declaring a SKILL Function

To refer to a group of statements by name, use the `procedure` declaration to associate a name with the group. The group of statements and the name make up a SKILL function.

- The name is known as the function name.
- The group of statements is the function body.

To run the group of statements, mention the function name followed immediately by `()`.

The `clearplot` command below erases the Waveform window and then plots a net.

```
procedure( clearplot( netname )
    clearAll( )
    plot( v (netName))
)
```

Defining Function Parameters

To make your function more versatile, you can identify certain variables in the function body as formal parameters.

When you start your function, you supply a parameter value for each formal parameter.

Defining Local Variables (let)

Local variables can be used to establish temporary values in a function. This is done using the `let` statement. When local variables are defined, they are known only within the `let` statement and are not available outside the `let` statement.

When the function is defined, the `let` statement includes the local variables you want to define followed by one or more SKILL expressions. The variables are initialized to `nil`. When the function runs, it returns the last expression computed within its body. For example:

```
procedure( test ( x )
    let(( a b )
        a=1
        b=2
        x * a+b
    )
)
```

- The function name is `test`.
- The local variables are `a` and `b`.
- The local variables are initialized to `nil`.
- The return value is the value of `x * a + b`.

SKILL Function Return Values

All SKILL functions compute a data value known as the return value of the function. Throughout this document, the right arrow (\Rightarrow) denotes the return value of a function call. You can

- Assign the return value to a SKILL variable
- Pass the return value to another SKILL function

Any type of data can be a return value.

Syntax Functions for Defining Functions

SKILL supports the following syntax functions for defining functions. You should use the `procedure` function in most cases.

procedure

The `procedure` function is the most general and is easiest to use and understand.

The `procedure` function provides the standard method of defining functions. Its return value is the symbol with the name of the function. For example:

```
procedure( trAdd( x y )
  "Display a message and return the sum of x and y"
  printf( "Adding %d and %d ... %d \n" x y x+y )
  x+y
) => trAdd
trAdd( 6 7 ) => 13
```


Terms and Definitions

`function, procedure`

In SKILL, the terms *procedure* and *function* are used interchangeably to refer to a parameterized body of code that can be executed with parameters in the function call bound to the parameters in the function definition. SKILL can represent a function as both a hierarchical list and as a function object.

`argument, parameter`

The terms *argument* and *parameter* are used interchangeably. The arguments in a function call correspond to the formal arguments in the declaration of the function.

`expression`

A use of a SKILL function, often by means of an operator supplying required parameters.

`function body`

The collection of SKILL expressions that define the function's algorithm.

OCEAN Environment Commands

This topic lists the OCEAN environment commands that let you start, control, and quit the OCEAN environment.

[appendPath](#)

[path](#)

[prependPath](#)

[setup](#)

[history](#)

[ocnSetSilentMode](#)

appendPath

```
appendPath(  
    t_dirName1 ... [ t_dirNameN ]  
)  
=> t_dirNameN / nil
```

Description

Appends a new path to the end of the search path list. You can append as many paths as you want with this command.

Arguments

<i>t_dirName1</i>	Directory path
<i>t_dirNameN</i>	Additional directory paths.

Value Returned

<i>t_dirNameN</i>	Returns the last path specified.
<i>nil</i>	Prints an error message if the paths cannot be appended.

Examples

Adds `/usr/mnt/user/processA/models` to the end of the current search path.

```
appendPath( "/usr/mnt/user/processA/models" )  
=> "/usr/mnt/user/processA/models"
```

Adds `/usr/mnt/user/processA/models` and `/usr/mnt/user/processA/models1` to the end of the current search path.

```
appendPath( "/usr/mnt/user/processA/models" "/usr/mnt/user/processA/models1")  
=> "/usr/mnt/user/processA/models"
```

path

```
path(  
    t_dirName1 ... [ t_dirNameN ]  
)  
=> l_pathList / nil
```

Description

Sets the search path for included files.

This command overrides the path set earlier using any of the following commands:

- path
- appendPath
- prependPath

Using this command is comparable to setting the Include Path for the direct simulator, or the `modelPath` for socket simulators in the Virtuoso® Analog Design Environment user interface. You can add as many paths as you want with this command.

Arguments

<i>t_dirName1</i>	Directory path
<i>t_dirNameN</i>	Additional directory path.

Value Returned

<i>l_pathList</i>	Returns the entire list of search paths specified.
<i>nil</i>	Prints an error message if the paths cannot be set.

Examples

Specifies that the search path includes `/models` followed by `/tmp/models`.

```
path( "~/models" "/tmp/models" )  
=> "~/models" "/tmp/models"
```

Returns the search path last set.

```
path()  
=> "~/models" "/tmp/models"
```

Related Topics

[appendPath](#)

[prependPath](#)

prependPath

```
prependPath(  
    t_dirName1 ... [ t_dirNameN ]  
)  
=> undefined / nil
```

Description

Adds a new path to the beginning of the search path list. You can add as many paths as you want with this command.

Arguments

<i>t_dirName1</i>	Directory path
<i>t_dirNameN</i>	Additional directory path.

Value Returned

undefined	The return value for this command/function is undefined.
nil	Prints an error message if the paths cannot be added.

Examples

Adds `/usr/mnt/user/processB/models` to the beginning of the search path list.

```
prependPath( "/usr/mnt/user/processB/models" )  
=> "/usr/mnt/user/processB/models"
```

Adds `/usr/mnt/user/processB/models` and `/usr/mnt/user/processB/models2` to the beginning of the search path list.

```
prependPath( "/usr/mnt/user/processB/models" "/usr/mnt/user/processB/models2")  
=> "/usr/mnt/user/processB/models"
```

Returns the search path last set.

```
prependPath()  
=> "/usr/mnt/user/processB/models" "~/models" "/tmp/models"
```

Related Topics

[path](#)

OCEAN Reference

OCEAN Environment Commands

appendPath

setup

```
setup(  
  [ ?numberNotation s_numberNotation ]  
  [ ?precision x_precision ]  
  [ ?reportStyle s_reportStyle ]  
  [ ?charsPerLine x_charsPerLine ]  
  [ ?messageOn g_messageOn ]  
)  
=> t / nil
```

Description

Specifies default values for parameters.

Arguments

?numberNotation *s_numberNotation*

Specifies the notation for printed information.

Valid values: 'suffix', 'engineering',
'scientific', 'none

Default value: 'suffix

The format for each value is 'suffix: 1m, 1u, 1n, etc.;
'engineering: 1e-3, 1e-6, 1e-9, etc.;
'scientific: 1.0e-2, 1.768e-5, etc.; 'none.

The value 'none' is provided so that you can turn off
formatting and therefore greatly speed up printing for
large data files.

?precision *x_precision*

Specifies the number of significant digits that are printed.

Valid values: 1 through 16

Default value: 6

?reportStyle *s_reportStyle*

OCEAN Reference

OCEAN Environment Commands

Specifies the format of the output of the report command.

Valid values: `spice`, `paramValPair`

Default value: `paramValPair`

The `spice` format is:

```
.....Param1... Param2....  
Param3
```

```
Name1.....value.....value.....va  
lue
```

```
Name2.....value.....value.....va  
lue
```

```
Name3.....value.....value.....va  
lue
```

The `paramValPair` format is:

```
Name1
```

```
Param1=value Param2=value Param3=value
```

```
Name2
```

```
Param1=value Param2=value Param3=value
```

```
Name3
```

```
Param1=value Param2=value Param3=value
```

`?charsPerLine` *x_charsPerLine*

Specifies the number of characters per line output to the display.

Default value: 80

`?messageOn` *g_messageOn*

Specifies whether error messages are turned on.

Valid values: `t`, `nil`

Default value: `t`, which specifies that messages are turned on.

Value Returned

t	The value is assigned to the parameter.
nil	Indicates an error.

Examples

Specifies that any printed information is to be in engineering mode by default.

```
setup( ?numberNotation 'engineering )  
=> t
```

Specifies that 5 significant digits are to be printed.

```
setup( ?precision 5 )  
=> t
```

Sets up number notation to `suffix` format, characters per line to 40, reporting style to `Spice`, and error message to `ON`.

```
setup(?numberNotation 'suffix ?charsPerLine 40 ?reportStyle 'spice ?messageOn t)
```

history

```
history(  
    [ x_number ]  
)  
=> t
```

Description

Displays the command history. By default, it the last twenty commands are listed from the current session and the most recently terminated session. More commands can be printed by giving a number as an argument.

Arguments

<i>x_number</i>	The number of previously entered commands to be listed. Default value: 20
-----------------	--

Value Returned

t	Indicates that the commands from history have been listed.
---	--

Examples

```
history  
1 simulator('spectre')  
2 design( "tests" "simple" "schematic")  
3 analysis( 'tran ?start 0 ?stop 1u ?step 10n )  
4 run()  
=> t
```

Displays the most recently used commands. To reuse any of these commands, use the following methods at the ocean prompt:

■ ocean> !1

This executes the command numbered 1, which in this example is `simulator('spectre')`.

■ ocean> !des

This executes the last command whose prefix starts with `des` in the history. In this example, it is the second command listed, that is, `design("tests" "simple" "schematic")`.

OCEAN Reference

OCEAN Environment Commands

Note: To run `history` in CIW, the syntax is:

`<space>!<commandNumber>`

For example:

■ `<space>!1`

This executes the command numbered 1 from the CIW.

ocnSetSilentMode

```
ocnSetSilentMode(  
    g_silentMode  
)  
=> t
```

Description

Filters out OCEAN warning and information messages and allows only error messages to be written. This functionality is useful while running the OCEAN scripts when you might want to skip all OCEAN messages except errors.

Arguments

<i>g_silentMode</i>	Accepts boolean values <code>t</code> or <code>nil</code> . Set to <code>t</code> to suppress the OCEAN warning and information messages. Set to <code>nil</code> to allow all OCEAN messages to be displayed.
---------------------	--

Value Returned

<code>t</code>	Returns <code>t</code> to indicate the successful assignment of the passed argument.
----------------	--

Examples

Suppresses the ocean warning messages.

```
ocnSetSilentMode(t)  
=> t
```

Displays the ocean warning messages

```
ocnSetSilentMode(nil)  
=> t
```

Simulation Commands

The following OCEAN simulation commands let you set up and run your simulation.

ac

analysis

converge

connectRules

createFinalNetlist

createNetlist

dc

definitionFile

delete

deleteOpPoint

design

desVar

discipline

displayNetlist

envOption

evcdFile

evcdInfoFile

forcenode

globalSigAlias

globalSignal

ic

OCEAN Reference

Simulation Commands

includeFile
modelFile
nodeset
noise
ocnCloseSession
ocnDisplay
ocnDspfFile
ocnSpefFile
ocnPspiceFile
ocnGetAdjustedPath
ocnGetInstancesModelName
off
option
restore
resultsDir
run
save
saveOpPoint
saveOption
simulator
solver
stimulusFile
store
temp
hlcheck
ocnAmsSetUnlNetlister

ac

```
ac (
    g_fromValue
    g_toValue
    g_ptsPerDec
)
=> undefined / nil

ac (
    g_fromValue
    g_toValue
    t_incType
    g_points
)
=> undefined / nil
```

Description

Specifies an AC analysis.

To know more about this analysis, see the simulator-specific user guide.

Arguments

<i>g_fromValue</i>	Starting value for the AC analysis.
<i>g_toValue</i>	Ending value
<i>g_ptsPerDec</i>	Points per decade
<i>t_incType</i>	Increment type Valid values: For the Spectre® circuit simulator, "Linear", "Logarithmic", or "Automatic". For other simulators, "Linear" or "Logarithmic".
<i>g_points</i>	Specifies the linear or logarithmic value, depending on the value set for <i>t_incType</i> .

Value Returned

<code>undefined</code>	The return value for this function is undefined.
<code>nil</code>	Prints an error message if the analysis is not specified.

Examples

Specifies an AC analysis from 1 to 10000 with 2 points per decade.

```
ac(1 10000 2)
```

Specifies an AC analysis from 1 to 10000 by 100.

```
ac(1 10000 "Linear" 100)
```

Specifies an AC analysis from 1 to 5000 with 10 logarithmic points per decade.

```
ac(1 5000 "Logarithmic" 10)
```

analysis

```
analysis(  
    s_analysisType  
    [ ?analysisOption1 g_analysisOptionValue1 ]... [ ?analysisOptionN  
    g_analysisOptionValueN ]  
    )  
=> undefined / nil
```

Description

Specifies the analysis to be simulated.

You can include as many analysis options as you want. Analysis options vary, depending on the simulator you are using. To include an analysis option, replace *analysisOption1* with the name of the desired analysis option and include another argument to specify the value for the option. If you have an AC analysis, the first option/value pair might be [*?from 0*].

Note: Some simplified commands are available for basic SPICE analyses. See the *ac*, *dc*, *tran*, and *noise* commands. Use the `ocnHelp('analysis')` command for more information on the analysis types for the simulator you choose.

Arguments

<i>s_analysisType</i>	Type of the analysis. The valid values for this argument depend on the analyses that the simulator contains. The basic SPICE2G-like choices: 'tran', 'dc', 'ac', and 'noise'.
-----------------------	---

<i>?analysisOption1 g_analysisOptionValue1</i>	Analysis option. The analysis options available depend on which simulator you use. (See the documentation for your simulator.) If you are using the Spectre® circuit simulator, see the information about analysis statements in the <i>Virtuoso Spectre Circuit Simulator Reference</i> for analysis options you can use.
--	--

<i>?analysisOptionN g_analysisOptionValueN</i>	Any subsequent analysis option. The analysis options that are available depend on which simulator you use. (See the documentation for your simulator.)
--	--

Value Returned

<code>undefined</code>	The return value for this function is undefined.
<code>nil</code>	Returns <code>nil</code> and prints an error message if there is a problem specifying the analysis.

Examples

Runs an AC analysis from 1Hz to 10000Hz with a linear step of 100Hz for the Spectre® circuit simulator.

```
analysis( 'ac ?start 1 ?stop 10000 ?lin 100 )
```

Specifies that a transient analysis must be performed from 0 to 1u with a sweep value of 10n for the Spectre.

```
analysis( 'tran ?start 0 ?stop 1u ?step 10n )
```

Specifies that the temperature sweep starts at -50 and stops at 100 for the Spectre® circuit simulator when DC analysis is performed.

```
analysis('dc ?oppoint "rawfile" ?save "allpub"  
        ?param "temp" ?start -50 ?stop 100 )
```

Saves the operating point information when performing DC analysis for Spectre.

```
analysis('dc ?saveOppoint t )
```

Specifies that a dc transfer function analysis must be performed from 0 to 100 with a linear sweep of 2 and frequency of 1 on the probe v4.

```
analysis('xf ?start 0 ?stop 100 ?lin 2 ?dev "v3" ?param "dc" ?freq 1 ?probe "v4")
```

Specifies that a Spectre sensitivity analysis must be performed with the dcOp, dc and ac analyses and the output is saved to the instance I7:3.

```
analysis('sens ?analyses_list list("dcOp" "dc" "ac") ?output_list list("I7:3"  
"OUT")
```

Specifies that a Spectre noise analysis must be performed from 1 to 10e6 and probes the operating point on instance V4.

```
analysis( 'noise ?start 1 ?stop 10e6 ?oprobe "V4" )
```

Specifies that a Spectre dcmatch analysis for the temperature of operating point PR1 is performed from 24 to 26°F with a linear sweep of 5.

```
analysis( 'dcmatch ?oprobe "/PR1" )  
analysis( 'dcmatch ?param "temp" ?start "24" ?stop "26" ?lin "5" )
```

OCEAN Reference Simulation Commands

Specifies that a Spectre pz analysis must be performed on the operating point rawfile with a frequency of 2 and fmax of 4.5GHz.

```
analysis('pz ?freq "2" ?readns "./abc" ?oppoint "rawfile" ?fmax "4.5GHz" ?zeroonly  
"no" ?prevoppoint "no" ?restart "no" ?annotate "no" ?stats "no"  
)
```

Specifies that a Spectre stability analysis must be performed from 10 to 10G on the probe instance PR1.

```
analysis('stb ?start "10" ?stop "10G" ?dec "10" ?probe "/PR1" ?prevoppoint "yes"  
?readns "./abc" ?save "lvl" ?nestlvl "1" ?oppoint "logfile" ?restart "yes"  
?annotate "no" ?stats "yes" )
```

Specifies that the Spectre pss RF analysis must be performed with fundamental frequency of 100M, solution harmonics set to 3, and a moderate error level.

```
analysis('pss ?fund "100M" ?harms "3" ?errpreset "moderate" )
```

Specifies that a Spectre pnoise RF analysis must be performed from 1K to 30M with a maxsideband of 3, a logarithmic sweep of 20, and input and output probes set to rf and rif respectively.

```
analysis('pnoise ?start "1K" ?stop "30M" ?log "20" ?maxsideband "3"  
?oprobe "/rif" ?iprobe "/rf" ?refsideband "0" )
```

Specifies that a Spectre pac RF analysis must be performed from 700M to 800M with a relative linear sweep of 5 and a maxsideband of 3.

```
analysis('pac ?sweeptype "relative" ?relharmnum "" ?start "700M" ?stop "800M"  
?lin "5" ?maxsideband "3")
```

Specifies that a Spectre pxf RF analysis must be performed from 10M to 1.2G with a linear sweep of 100 and maxsideband of 3 between the open terminals Plo and gnd!.

```
analysis('pxf ?start "10M" ?stop "1.2G" ?lin "100" ?maxsideband "3" ?p "/Plo"  
?n "/gnd!" )
```

Specifies that a Spectre qpss RF analysis must be performed from -25 to -10 with a linear sweep of 5 for the fundamental frequencies of flo and frf. Here, the number of harmonics of each fundamental to be considered is 0, the number of parameters to be updated are saved in prf, and the error level is set to moderate.

```
analysis('qpss ?funds list("flo" "frf") ?maxharms list("0" "0") ?errpreset  
"moderate" ?param "prf" ?start "-25" ?stop "-10" ?lin "5" )
```

Specifies that a Spectre qpac analysis must be performed from 920M with clockmaxharm set to 0.

```
analysis('qpac ?start "920M" ?stop "" ?clockmaxharm "0" )
```

Specifies that the S-Parameter analysis must be performed from 100M to 1.2G with a sweep value of 100 between the open terminals /Port0 and /RF. Additionally, noise analysis is also performed.

```
analysis('sp ?start "100M" ?stop "1.2G" ?step "100" ?donoise "yes"  
?oprobe "/PORT0" ?iprobe "/RF"  )
```

Related Topics

[Analysis Statements](#)

converge

```
converge(  
    s_convName  
    t_netName1  
    f_value1 ... [ t_netNameN f_valueN ]  
)  
=> undefined / nil
```

Description

Sets convergence criteria on nets.

Arguments

<i>s_convName</i>	Name of the convergence type. Valid values are <code>nodeset</code> and <code>forcenode</code> . Note: <code>forcenode</code> is not supported for Spectre.
<i>t_netName1</i>	Name of the net to which you want to set convergence criteria.
<i>f_value1</i>	Voltage value for the net.
<i>t_netNameN</i>	Name of the additional net.
<i>f_value</i>	Voltage value for the additional net.

Value Returned

<code>undefined</code>	The return value for this function is undefined.
<code>nil</code>	Prints an error message if the function fails.

Examples

Sets the convergence name for the initial condition `net1` to 5 volts.

```
converge( 'ic "/I0/net1" 5 )
```

Sets the convergence name for `nodeset` of `net1` to 5 volts.

```
converge( 'nodeset "/I0/net1" 5 )
```

Related Topics

[Helping Simulations to Converge](#)

connectRules

```
connectRules(  
    t_ruleName  
    [ ?lib t_libName ]  
    [ ?view t_viewName ]  
    [ ?baseRule t_baseRule ]  
    [ ?moduleInfo l_moduleInfo ]  
    [ ?resolutionInfo l_resolutionInfo ]  
    [ ?commonParam l_commonParam ]  
    [ ?userDefined s_userDefined ]  
)  
=> t / nil  
  
connectRules (  
    t_ruleName  
)  
=> t / nil  
  
connectRules(  
    ?none s_tag  
)  
=> t / nil
```

The following arguments are composed of other arguments as described below:

```
l_moduleInfo:      ((s_moduleName1 [?mode s_mode] [?paramInfo l_paramInfo]  
                    [ ?direction1 s_direction1][?discipline1 s_discipline1 ]  
                    [ ?direction2 s_direction2] [?discipline2 s_discipline2 ])  
                    [ (s_moduleName2 - ) - ])  
  
l_paramInfo:       ((s_paramName1 s_value1) [ (s_paramName2 s_value2) - ])  
  
l_resolutionInfo:  ((s_resolvedDiscipline1 s_equivalentDisciplines1)  
                    [ (s_resolvedDiscipline2 s_equivalentDisciplines2) - ])  
  
l_commonParam:     ((s_paramName1 s_value1 [ (s_moduleName1 s_moduleName2 - ) ])  
                    [ (s_paramName2 s_value2 ) - ])
```

Description

Sets connect rules for a given AMS OCEAN session required by the elaborator. To specify multiple connect rules, use this command multiple times. To add a connect rule to an OCEAN session, you can either choose a built-in rule from the `connectLib` library (by specifying `t_ruleName`, `t_libName` and `t_viewName`) or one of your own compiled built-in connect rules (by specifying `t_ruleName`, `t_libName` and `t_viewName`). To add a user defined connect rule to an OCEAN session specify `s_userDefined`. To modify an existing built-in rule, you need to specify `t_baseRule` (the name of the built-in rule that needs be

modified), specify a new name (by specifying *t_ruleName*, *t_libName* and *t_viewName*) and also specify one or more of the optional arguments.

You can use the `delete('connectRules)` command to delete one or more specified connect rules. See the examples provided with the `delete` command.

You can use `ocnDisplay('connectRules)` to view the currently active connect rules in an OCEAN session. You may use `ocnDisplay('connectRules 'all)` to display all information about all active connect rules in an OCEAN session.

Note: This command is applicable only when `ams` is the selected simulator.

Arguments

<i>t_ruleName</i>	Name of the connect rule that you want to use in the current session.
<i>t_libName</i>	Name of the library that contains a list of user-compiled connect rules. If you do not specify this, the connect rules are assumed to be in the default location.
<i>t_viewName</i>	Name of the view of the selected cell.
<i>t_baseRule</i>	Name of the connect rule that you want to modify.
<i>l_moduleInfo</i>	<p>Arguments that need to be updated for a specified connect rule. The arguments may include <i>s_mode</i>, <i>s_direction1</i>, <i>s_direction2</i>, <i>s_discipline1</i> and <i>s_discipline2</i>.</p> <p>Valid values for <i>s_mode</i> are <code>null</code>, <code>split</code>, <code>merged</code>.</p> <p><i>s_direction1</i> and <i>s_direction2</i> work as a pair. Valid combinations are <code>null</code>, <code>input/output</code>, <code>output/input</code>, <code>inout/inout</code>.</p> <p><i>s_discipline1</i> and <i>s_discipline2</i> also work as a pair. Either both the arguments must be set to <code>null</code> or they should both have values.</p>
<i>t_resolutionInfo</i>	<p>Names of disciplines that need to be resolved to another discipline. The value specified overwrites the <i>l_resolutionInfo</i> in the base rule or in the existing connect rule.</p>

<i>t_commonParam</i>	One or more parameters that you want to modify for all modules or a set of modules. Although the same result can be achieved by using the <i>l_moduleInfo</i> argument, <i>l_commonParam</i> facilitates updating parameters for all modules in one go.
<i>s_userDefined</i>	Name of the user defined connect rule that you want to use in the current session. Specify <i>3step</i> as the value of <i>s_userDefined</i> and specify <i>t_ruleName</i> , <i>t_libName</i> and <i>t_viewName</i> to add a user defined connect rule for the AMS UNL flow. Specify <i>irun</i> as the value of <i>s_userDefined</i> and specify <i>t_ruleName</i> , <i>s_fileName</i> or both to add a user defined connect rule for the OSS-based netlister with <i>irun</i> flow. Any other argument specified when adding a user defined connect rule will be ignored.
<i>s_tag</i>	Indicates that no connect rules are to be used for the current session.

Value Returned

<i>t</i>	The specified connect rules are set.
<i>nil</i>	Prints an error message.

Examples

Sets *ConnRules_5V_full* as the current connect rule from the default *connectLib* located in your hierarchy.

```
connectRules("ConnRules_5V_full")
```

Sets *CustomRules_9V_high* from *myConnectLib*, where *myConnectLib* contains a list of user-compiled connect rules and *myViewName* is the specified view name.

```
connectRules("CustomRules_9V_high" ?lib "myConnectLib" ?view "myViewName")
```

Checks if *connRule3* exists in the session. If it does, it updates *direction1* to input and *direction2* to output for E2L and *description* for this rule. If this rule does not exist, then it takes the base values as values from *ConnRules_18V_full* and updates *direction1*, *direction2*, and *description* and names the new rule as *connRule3*.

```
connectRules("connRule3" ?lib "lib2" ?view "view2" ?baseRule "ConnRules_18V_full"  
?description "updated directions" ?moduleInfo ((?name "E2L" ?direction1 "input"  
?direction2 "output")))
```

Checks if `connRule3` exists. If it does not exist, as no base rule is specified, a relevant error message appears. If the rule exists, it would update `mode` to `split` for the existing connect rule `connRule3` for the module `E2L`.

```
connectRules("connRule3" ?lib "lib2" ?view "view2" ?moduleInfo ((?name "E2L" ?mode "split")))
```

If `connRule3` does not exist and the base rule is not specified but `description`, `moduleInfo` and `resolutionInfo` are specified, the connect rule `connRule3` is added with the values specified for `moduleInfo`, `resolutionInfo` and `description`.

In this case, no checks are done. This means that module names and parameter names are not checked against base information as no base rule information is available) This command is applicable while using the `connectRules` command as saved in OCEAN.

```
connectRules("connRule3" ?lib "lib2" ?view "view2" ?description "desc123"
?moduleInfo ((?name "E2L" ?mode "split" ?direction1 "input" ?direction2 "output"))
?resolutionInfo nil)
```

Updates the parameters `vsup` and `vtlo` for the existing rule `connRule3` in the `L2E` module.

```
connectRules("connRule3" ?lib "lib2" ?view "view2" ?moduleInfo ((?name "L2E"
?paramInfo (("vsup" "1.7") ("vtlo" "3.2"))))
```

Updates `resolutionInfo` for the existing connect rule `connRule3`. The old `resolutionInfo` value for this rule is replaced with the new information. It also updates the `vsup` parameter to 1.2 for all `connRule3` modules and updates `vtlo` to 3.4 for the modules `L2E` and `Bidir`.

```
connectRules("connRule3" ?lib "lib2" ?view "view2" ?resolutionInfo (("r1" "e1
e2") ("r2" "e4 e5")) ?commonParam (("vsup" "1.2") ("vtlo" "3.4" ("L2E" "Bidir"))
```

Sets `connRule3` from `view2` of `lib2` as a user defined connect rule for the Cellview-based netlister flow.

```
connectRules("connRule3" ?lib "lib2" ?view "view2" ?userDefined 3step)
```

Sets `connRule3` from the `connectLib` library as a user defined connect rule for the OSS-based netlister with `irun` flow.

```
connectRules("connRule3" ?userDefined irun)
```

Sets `connRule3` from `file1` as a user defined connect rule for the OSS-based netlister with `irun` flow.

```
connectRules("connRule3" ?userDefined irun ?file "file1")
```

No user-defined connect rule name is specified for the OSS-based netlister with `irun` flow. Hence, the first rule found in `file1` will be used for AMS simulation.

```
connectRules(?userDefined irun ?file "file1")
```

OCEAN Reference

Simulation Commands

Sets the current connect rule to `None` so that no connect rule is provided to ncelab during elaboration.

```
connectRules(?none t)
=> t
```

Deletes the connect rule `myrule` in the library `mylib` with the view `myview`. It also deletes the connect rule `myrule1` in the library `mylib1` with the view `myview1`.

```
delete('connectRules list("mylib" "myrule" "myview") list("mylib1" "myrule1"
"myview1"))
```

Deletes the specified connect rule `rule1` from the default `connectLib` library.

```
delete('connectRules list("" "rule1" ""))
```

createFinalNetlist

```
createFinalNetlist(  
    )  
=> t / nil
```

Description

Creates the final netlist for viewing purposes. The netlist also can be saved but is not required to run the simulator.

Note: This command works only for socket simulators. For direct simulators, such as Spectre, use `createNetlist` instead.

Arguments

None

Value Returned

<code>t</code>	The final netlist is created.
<code>nil</code>	Prints an error message.

Examples

Creates the final netlist for the current simulation run.

```
createFinalNetlist()  
=> t
```

createNetlist

```
createNetlist(  
    [ ?recreateAll g_recreateAll ]  
    [ ?display g_display ]  
)  
=> t_filename / nil
```

Description

Creates the simulator input file.

If the design is specified as a cellview, this command netlists the design, if required, and creates the simulator input file. When the *g_recreateAll* argument is set to *t* and the design is specified as cellview, all the cells in the design hierarchy are renetlisted, before creating the simulator input file. If the design is specified as netlist file, that netlist is included in the simulator input file.

Note: This command does not work with socket simulators.

Arguments

?g_recreateAll g_recreateAll

Specifies if the netlist needs to be recreated or not.

?display g_display

Specifies if the netlist is to be displayed or not.

Value Returned

t_filename

Returns the name of the simulator input file.

nil

Indicates an error.

Examples

Creates simulator input file for the current simulation run.

```
createNetlist()  
=> "/usr/foo/netlist/input.scs"
```

Netlists and creates simulator input file for the current simulation run.

```
design( "test" "mytest" "spectre")
```

OCEAN Reference

Simulation Commands

```
createNetlist( ?recreateAll t )  
=>"/usr/foo/netlist/input.scs"
```

Netlists and creates simulator input file for the given simulation run but does not display the `input.scs` file in a new window. By default, the `?display` argument is set to `t` which means that netlist file would be displayed.

If you regenerate the netlist after changing the design in a different Virtuoso session, the netlist is not updated with the design changes. To update the netlist with the current cellview, run the `ddsRefresh` command before running the `createNetlist` command as shown below:

```
design( "test" "mytest1" "spectre")  
createNetlist( ?recreateAll t ?display nil )  
=>"/usr/foo/netlist/input.scs"
```

Note: If you regenerate the netlist after changing the design in a different Virtuoso session, the netlist is not updated with the design changes. To update the netlist with the current cellview, run the `ddsRefresh` command before running the `createNetlist` command as shown below:

```
ddsRefresh( ?cellview t )  
=> t  
createNetlist( ?recreateAll t )  
=> "/usr/foo/netlist/input.scs"
```

Related Topics

[design](#)

[ddsRefresh](#)

dc

```
dc (  
    t_compName  
    [ t_compParam ]  
    g_fromValue  
    g_toValue  
    g_byValue  
    )  
=> undefined / nil
```

Description

Specifies a DC sweep analysis with limited options. If other analysis options are needed, use the `analysis` command.

To know more about this analysis, see the simulator-specific user guide.

Note: *t_compParam* is valid only for Spectre.

Arguments

<i>t_compName</i>	Name of the source or component to be swept by Spectre.
<i>t_compParam</i>	Indicates that the component parameter is to be swept by Spectre.
<i>g_fromValue</i>	Starting value for the DC analysis.
<i>g_toValue</i>	Ending value
<i>g_byValue</i>	The increment at which to step through the analysis.

Value Returned

<code>undefined</code>	The return value for this function is undefined.
<code>nil</code>	Prints an error message if the analysis is not specified.

Examples

Specifies two DC sweep analyses for Spectre.

```
dc("v1" "dc" 0 5 1)
dc("r1" "r" 0 5 1)
```

Specifies one DC sweep analysis for a simulator other than Spectre.

```
dc("v1" 0 5 1)
```

definitionFile

```
definitionFile(  
    t_fileName [ t_fileName2 ... t_fileNameN ]  
)  
=> l_fileNames / nil
```

Description

Specifies definitions files to be included in the simulator input file.

Definitions files define functions and global variables that are not design variables. Examples of such variables are model parameters or internal simulator parameters.

Note: This command does not work with socket simulators.

Arguments

<i>t_fileName</i>	The name of the definition file that would typically contain functions or parameter statements.
-------------------	---

Value Returned

<i>l_fileNames</i>	Returns a list of the specified file names.
<i>nil</i>	Indicates an error.

Examples

Includes `functions.def` and `constants.def` files in the simulator input file.

```
definitionFile( "functions.def" "constants.def" )  
=> ("functions.def" "constants.def")
```

Returns the definition files set earlier.

```
definitionFile( )  
=> ("functions.def" "constants.def")
```

delete

```
delete(  
    s_command  
    [ g_commandArg1 ] [ g_commandArg2 ] ...  
)  
=> t / nil
```

Description

Deletes all the information specified.

The *s_command* argument specifies the command whose information you want to delete. If you include only this argument, all the information for the command is deleted. If you supply subsequent arguments, only information specified by these arguments is deleted, and not all the information for the command.

Arguments

<i>s_command</i>	Command that was initially used to add the items that are now being deleted. Valid values: <i>analysis</i> , <i>connectRules</i> , <i>discipline</i> , <i>globalSignal</i> , <i>desVar</i> , <i>path</i> , <i>save</i> , <i>ic</i> , <i>forcenode</i> , and <i>nodeset</i>
<i>g_commandArg1</i>	Argument corresponding to the specified command.
<i>g_commandArg2</i>	Additional argument corresponding to the specified command.

Value Returned

<i>t</i>	Indicates that the the information is deleted.
<i>nil</i>	Indicates an error.

Examples

Deletes all the saves.

```
delete( 'save' )  
=> t
```

Deletes only the nets. The rest of the information can be saved in subsequent simulations.

OCEAN Reference

Simulation Commands

```
delete( 'save 'v ' )  
=> t
```

Deletes only `net23`. The rest of the information can be saved in subsequent simulations.

```
delete( 'save "net23" ' )  
=> t
```

Turns off the `monteCarlo` command and sets everything back to the defaults.

```
delete( 'monteCarlo ' )  
=> t
```

deleteOpPoint

```
deleteOpPoint(  
    t_instName  
    [ @rest l_args ]  
)  
=> t / nil
```

Description

Deletes the specified operating point instance.

Arguments

<i>t_instName</i>	Name of the operating point instance to be deleted.
<i>@rest l_args</i>	List of optional arguments that can be passed to this function.

Values Returned

<i>t</i>	The specified operating point instance is deleted.
<i>nil</i>	Indicates an error.

Examples

This example deletes the operating point instance I8/Q3.

```
deleteOpPoint( "I8/Q3" )
```

design

```
design(  
    t_cktFile | t_lib t_cell t_view [ t_mode ]  
)  
=> t_cktFile / nil | (t_lib t_cell t_view) / nil
```

Description

Specifies the directory path to the netlist of a design or the name of a design to be simulated.

For the *lib*, *cell*, *view* version of the `design` command, you can specify the design mode as *r*, *w*, or *a*, representing *read*, *write*, or *append* respectively.

Arguments

<i>t_cktFile</i>	Directory path to the netlist followed by the name of the netlist file. Name of the netlist file must be <code>netlist</code> . The <code>netlistHeader</code> and <code>netlistFooter</code> files must be in the same directory. Otherwise, <i>cktFile</i> is a pre-existing netlist file from another source.
<i>t_lib</i>	Name of the library that contains the design.
<i>t_cell</i>	Name of the design.
<i>t_view</i>	View of the design (typically <code>schematic</code>).
<i>t_mode</i>	The mode in which the design should be opened. The value can be <i>r</i> , <i>w</i> or <i>a</i> , representing <i>read</i> , <i>write</i> , and <i>append</i> , respectively. The default mode is <i>append</i> . Read-only designs can be netlisted only by direct netlisters, and not socket. The <i>w</i> mode should not be used as it overwrites the design.

Value Returned

<code>t_cktFile</code>	Returns the name of the design.
<code>l_(lib cell view)</code>	Returns the name of the maestro view.
<code>nil</code>	Prints an error message if there is a problem using the specified design.

Examples

Specifies that the netlist file `netlist` must be used for the simulation.

```
design( "./opampNetlist/netlist" )  
=> netlist
```

Specifies that the `schematic` view of the `simple` design from the `tests` library must be used in the simulation.

```
design( "tests" "simple" "schematic" )  
=> (tests simple schematic)
```

Specifies that the `schematic` view of the `ampTest` design from your `mylib` library be appended to the simulation.

```
design("mylib" "ampTest" "schematic" "a")  
=> (mylib ampTest schematic)
```

Returns the name of the library, cell, and view being used in the current session. If a design has not been specified, it returns `nil`.

```
design()  
=> (mylib ampTest schematic)
```


desVar

```
desVar(  
    t_desVar1 f_value1 ... [ t_desVarN f_valueN ]  
)  
=> undefined / nil
```

Description

Sets the values of design variables used in your design. You can set the values for as many design variables as you want.

Arguments

<i>t_desVar1</i>	Name of the design variable.
<i>f_value1</i>	Value for the design variable.
<i>t_desVarN</i>	Name of an additional design variable.
<i>f_valueN</i>	Value for the additional design variable.

Value Returned

undefined	The return value for this command or function is undefined.
nil	Prints an error message if the assignments fail.

Examples

Returns the design variables set last, if any. Otherwise, it returns `nil`.

```
desVar( )
```

Sets the `rs` design variable to 1k.

```
desVar( "rs" 1k )
```

Sets the `r1` design variable to `rs`, or 1k, and sets the `r2` design variable to `rs*2`, or 2k.

```
desVar( "r1" "rs" "r2" "rs*2" )
```

Sets `a` to 1k/2 or 500.

Note: `evalstring` is necessary because `desVar` returns a string.

```
a = evalstring( desVar( "rs" ) ) / 2
```

discipline

```
discipline(  
    g_discipline1 [ g_discipline2 ... ]  
)  
=> t / nil
```

Description

Adds discrete disciplines to the existing set of disciplines for a given AMS OCEAN session. You can use `delete('discipline)` to delete one or more specified disciplines. You can use `ocnDisplay('discipline)` to view the currently active disciplines in an OCEAN session.

Note: This command is applicable only for AMS simulator.

Arguments

<i>g_discipline1</i>	Name of the discrete discipline to be added.
<i>g_discipline2</i>	Names of additional discrete disciplines to be added.

Value Returned

<i>t</i>	The discrete disciplines are added.
<i>nil</i>	Prints an error message.

Examples

Disciplines to be added can be either strings or lists containing the discipline name. If no disciplines have been added so far, this sample command adds the three discrete disciplines `logic1`, `logic2` and `logic3` to the session; otherwise, it adds these three disciplines to the existing set of disciplines.

```
discipline( "logic1" "logic2" '("logic3") )  
=> t
```

Adds discipline `LL` to the existing set of disciplines. If `logic1`, `logic2` and `logic3` are already added, `LL` is added as the fourth discipline.

```
discipline("LL")  
=> t
```

Deletes disciplines `logic2` and `LL` from the session.

OCEAN Reference

Simulation Commands

```
delete('discipline "logic2" "LL")  
=> t
```

Deletes all the specified disciplines in the session.

```
delete('discipline')  
=> t
```

displayNetlist

```
displayNetlist(  
    )  
=> t / nil
```

Description

Displays the concatenated design information file used in a given OCEAN session for AMS. The concatenated file displays the netlisting of the cellviews used in the configuration along with the analog control file and the generated TCL file. This command is applicable for Spectre.

Note: This command is applicable only for AMS simulator.

Arguments

None

Value Returned

t	The concatenated design information file is displayed.
nil	Prints an error message.

Examples

Displays the concatenated design information file.

```
displayNetlist()  
=> t
```

envOption

```
envOption(  
    s_envOption1 g_value1 ... [ s_envOptionN g_valueN ]  
)  
=> undefined / nil
```

Description

Sets environment options.

To get the list of environment options that can be set for a simulator, first set the simulator and then run the OCEAN online help command `ocnHelp('envOption')`.

For example, setting the following command displays a list of environment options that can be set for Spectre.

```
simulator('spectre)  
ocnHelp('envOption)
```

Note: To specify an include file, use the `includeFile` command instead of the `envOption` command. Similarly, to set a model path, use the `path` command instead of the `envOption` command.

Arguments

<i>s_envOption1</i>	Name of the first environment option to set.
<i>g_value1</i>	Value for the environment option to be set.
<i>s_envOptionN</i>	Name of an additional environment option to set.
<i>g_valueN</i>	Value for the additional environment option to be set.

Value Returned

<code>undefined</code>	The return value for this command or function is undefined.
<code>nil</code>	Indicates an error.

Examples

Sets the `paramRangeCheckFile` environment option.

```
envOption( 'paramRangeCheckFile' "./myDir/range.check" )
```

Sets the `initFile` environment option.

```
envOption( 'initFile' "./myDotSFiles/init" )
```

Sets the `updateFile` environment option.

```
envOption( 'updateFile' "./myDotSFiles/update" )
```

evcdFile

```
evcdFile(  
    t_evcdFileName  
)  
=> t_evcdFileName / nil
```

Description

Sets an EVCD file for a given UltraSim OCEAN session. You also need to specify an EVCD information file while using this command. You can specify only one EVCD file for a session. You may use `ocnDisplay('evcdFile)` to view the currently active EVCD file.

Note: This command is applicable for the UltraSim simulators.

Arguments

<i>t_evcdFileName</i>	The name of the EVCD file to be used for session.
-----------------------	---

Value Returned

<i>t_evcdFileName</i>	Path to the EVCD information file is returned.
<i>nil</i>	Indicates an error

Examples

Specifies `/tmp/evcdFile.dat` as the EVCD file to be used for the current UltraSim OCEAN session.

```
evcdFile("/tmp/evcdFile.dat")  
=> "/tmp/evcdFile.dat"
```

evcdInfoFile

```
evcdInfoFile(  
    t_evcdInfoFileName  
)  
=> t_evcdInfoFileName / nil
```

Description

Sets an EVCD information file for a given UltraSim OCEAN session. You also need to specify an EVCD file while using this command. You can specify only one EVCD information file for a session. You may use `ocnDisplay('evcdInfoFile)` to view the currently active EVCD information file.

Note: This command is applicable only for the UltraSim simulator.

Arguments

t_evcdInfoFileName

The name of the EVCD information file to be included.

Value Returned

t_evcdInfoFileName

Path to the EVCD information file is returned.

nil

Indicates an error.

Examples

Specifies `/tmp/evcdInfoFile.dat` as the EVCD file to be used for current UltraSim OCEAN session.

```
evcdInfoFile("tmp/evcdInfoFile.dat")  
=> "/tmp/vcdInfoFile.dat"
```


forcenode

```
forcenode(  
    t_netName1 f_value1 ... [ t_netNameN f_valueN ]  
)  
=> undefined / nil
```

Description

Holds a node at a specified value.

Note: This command is not available for Spectre. Refer to the documentation for your simulator to see if this feature is available for your simulator.

Arguments

<i>t_netName1</i>	Name of the net.
<i>f_value1</i>	Voltage value for the net.
<i>t_netNameN</i>	Name of an additional net.
<i>f_valueN</i>	Voltage value for the net.

Value Returned

<i>undefined</i>	The return value for this command or function is undefined.
<i>nil</i>	Prints an error message.

Examples

Sets the force nodes of "net1" to 5 and "net34" to 2.

```
forcenode( "net1" 5 "net34" 2 )
```

globalSigAlias

```
globalSigAlias(  
    g_signalList1 [ g_signalList2 ... ]  
)  
=> t / nil
```

Description

Removes all the previous signal aliases and creates the specified aliases. The signal names in each of the signal lists are marked as aliases of each other. Each of the signal lists is a set of signal names that are to be aliased. The signal names should match the names that were specified using the `globalSignal` command. To remove the aliases for all signals, specify `nil` instead of the signal lists.

Note: This command is applicable only when AMS is the simulator.

Arguments

<code>g_signalList(n)</code>	A list of signals that are to be marked as aliases of each other.
------------------------------	---

Value Returned

<code>t</code>	The previous signal aliases are removed successfully and new aliases are created according to the specified signal lists.
<code>nil</code>	Prints an error message.

Examples

Removes the previous signal aliases and marks `sig1` and `sig2` as aliases of each other and `sig4`, `sig5` and `sig8` as aliases of each other. The signal names in each of the signal lists are marked as aliases of each other.

```
globalSigAlias('("sig1" "sig2")' ("sig4" 'sig5' 'sig8'))  
=> t
```

If there is just one list of signals to be aliased, it can be given without the list. In this case, `signal2`, `signal6` and `signal3` are marked as aliases of each other.

```
globalSigAlias("signal2" "signal6" "signal3")  
=> t
```

Related Topics

[globalSignal](#)

globalSignal

```
globalSignal(  
  [ ?name t_signalName ]  
  [ ?lang t_langName ]  
  [ ?wireType t_wireType ]  
  [ ?discipline t_discipline ]  
  [ ?ground t_ground ]  
  @Rest args  
)  
=> t / nil
```

Description

Adds or modifies a global signal for a given AMS OCEAN session needed by the elaborator. If the global signal already exists in the session, the values are updated. If it does not exist, a global signal with the specified name is added. In case of a vector signal, the range information can be appended with the name of the signal.

Note: This command is applicable only when AMS is the simulator.

Arguments

`?name t_signalName`

The name of the global signal to be added.

`?lang t_langName`

The namespace within which the signal is entered. It is used to map the signal name to Verilog-AMS.

Valid Values: CDBA, Spectre, Spice, and Verilog-AMS

Default Value: CDBA

`?wireType t_wireType`

Indicates the Verilog type of the signal declaration.

Valid Values: wire, supply0, supply1, tri, tri0, tri1, triand, trior, trireg, wand, wor, and wreal

Default Value: wire

`?discipline t_discipline`

A string value to indicate the discipline of the signal.

`?ground t_ground`

Valid Values: YES, NO

Default Value: NO

`@Rest args`

List of optional arguments that can be passed to this function.

Value Returned

`t`

The specified global signal is added or modified successfully.

`nil`

Prints an error message.

Examples

Adds the global signal `signal1` with wire type as `tri`, default language as `CDBA`, and ground as `NO` to the list of global signals if it has not already been added. If it already exists, then it updates the wire type for `signal1`.

OCEAN Reference

Simulation Commands

```
globalSignal("signal1" ?wireType "tri")  
=> t
```

Adds `signal2` with language as `Spectre`, discipline as `electrical`, and ground as `NO` to the list of global signals if it is not already added. If it already exists, then it updates language to `Spectre` and discipline to `electrical`.

```
globalSignal("signal2" ?lang "Spectre" ?discipline "electrical")  
=> t
```

Deletes `sig1` and `sig2` after removing their aliases if they are in aliased sets.

```
delete('globalSignal "sig1" "sig2")  
=> t
```

Deletes all user-specified global signals.

```
delete('globalSignal)  
=> t
```

ic

```
ic(  
    t_netName1 f_value1 ... [ t_netNameN f_valueN ]  
)  
=> undefined / nil
```

Description

Sets initial conditions on nets in a transient analysis.

Arguments

<i>t_netName1</i>	Name of the net.
<i>f_value1</i>	Voltage value for the net.
<i>t_netNameN</i>	Name of an additional net.
<i>f_valueN</i>	Voltage value for the net.

Value Returned

<code>undefined</code>	The return value for this command or function is undefined.
<code>nil</code>	Prints an error message.

Examples

Holds the nodes of `"/net1"` at 5 and `"/net34"` at 2.

```
ic( "/net1" 5 "/net34" 2 )
```

includeFile

```
includeFile(  
    t_fileName  
)  
=> t_fileName / nil
```

Description

Includes the specified file in the final netlist of the simulator for the current session.

Notes:

1. This command is not available for the direct simulator. Use the `modelFile` or `stimulusFile` command instead.
2. Using this command is comparable to using the Environment Options form of the Virtuoso® Analog Design Environment to name an include file and specify that the syntax for the file be that of the target simulator. If you want the include file to be in Cadence-SPIICE circuit simulator syntax, you must edit the raw netlist file (which has a `.c` or `.C` suffix), and manually add the include file.

Arguments

<i>t_fileName</i>	Name of the file to include in the final netlist.
-------------------	---

Value Returned

<i>t_fileName</i>	Returns the name of the file if successful.
<i>nil</i>	Returns <i>nil</i> and prints an error message otherwise.

Example

```
includeFile( "~/projects/nmos" )  
=> "~/projects/nmos"
```

Includes the `nmos` file in the final netlist of the simulator for the current session.

```
includeFile()  
=> "~/projects/nmos"
```

Returns the `includeFile`, if one was set earlier. Otherwise, it returns *nil*.

modelFile

```
modelFile(  
    [ g_modelFile1 [ g_modelFile2 ... ] ]  
)  
=> l_modelFile
```

Description

Specifies model files to be included in the simulator input file.

This command returns the model files used. When model files are specified through the arguments, the model files are set accordingly. Use of full paths for the model file is recommended.

Arguments

<i>g_modelFile1</i>	This argument can be a string to specify the name of the model file.
<i>g_modelFile2</i>	This argument can be a list of two strings to specify the name of the model file and the name of the section.

Value Returned

<i>l_modelFile</i>	A list of all the model file/section pairs.
<i>nil</i>	Returned when no file section pairs have been specified with the current call or a previous call of this command. The <i>nil</i> value is also returned when an error has been encountered.

Example

```
modelFile( "bjt.scs" "nmos.scs" )  
=>( ("bjt.scs" "") ("nmos.scs" ""))  
  
modelFile( "bjt.scs" '("nmos.scs" "typ") 'my_models )  
=> ( ("bjt.scs" "") ("nmos.scs" "typ") ("my_models" ""))  
  
modelFile()  
=> ( ("bjt.scs" "") ("nmos.scs" ""))
```

Returns the *modelFile*, if one was set earlier. Otherwise, it returns *nil*.

nodeset

```
nodeset (
    t_netName1 f_value1 ... [ t_netNameN f_valueN ]
)
=> undefined / nil
```

Description

Sets the initial estimate for nets in a DC analysis, or sets the initial condition calculation for a transient analysis.

To know more about convergence, refer to the chapter *[Helping a Simulation to Converge](#)* of the *Virtuoso Analog Design Environment L User Guide*.

Arguments

<i>t_netName1</i>	Name of the net.
<i>f_value1</i>	Voltage value for the net.
<i>t_netNameN</i>	Name of an additional net.
<i>f_valueN</i>	Voltage value for the net.

Value Returned

<code>undefined</code>	The return value for this command/function is undefined.
<code>nil</code>	Returns <code>nil</code> and prints an error message otherwise.

Example

```
nodeset( "net1" 5 "net34" 2 )
```

Sets the initial estimates of "net1" to 5 and "net34" to 2.

noise

```
noise(  
    t_output  
    t_source  
)  
=> undefined / nil
```

Description

Specifies a noise analysis.

Note: This command cannot be used with the spectre simulator.

Arguments

<i>t_output</i>	Output node
<i>t_source</i>	Input source

Value Returned

<code>undefined</code>	The return value for this command/function is undefined.
<code>nil</code>	Returns <code>nil</code> and prints an error message If there is a problem specifying the analysis.

Example

```
noise( "n1" "v1" )
```

Specifies a noise analysis.

ocnCloseSession

```
ocnCloseSession(  
    )  
=> t / nil
```

Description

Closes the current OCEAN session without saving any settings made during the session. The command has no effect if no session is currently active.

Value Returned

<code>t</code>	Returns <code>t</code> when the current session is successfully closed.
<code>nil</code>	Returns <code>nil</code> if there is a problem closing the active session.

Example

```
ocnCloseSession()  
=> t
```

Closes the current OCEAN session.

ocnDisplay

```
ocnDisplay(  
  [ ?output t_filename | p_port ]  
  s_command  
  [ g_commandArg1 ] [ g_commandArg2 ] ...  
)  
=> t / nil
```

Description

Displays all the information specified.

The *s_command* argument specifies the command whose information you want to display. If you include only this argument, all the information for the command displays. If you supply subsequent arguments, only those particular pieces of information display as opposed to displaying all the information for that command. If you provide a filename as the ?output argument, the `ocnDisplay` command opens the file and writes the information to it. If you provide a port (the return value of the `SKILL outfile` command), the `ocnDisplay` command appends the information to the file that is represented by the port.

Arguments

<code>?output</code> <code>t_filename</code>	File in which to write the information. The <code>ocnDisplay</code> command opens the file, writes to the file, then closes the file. If you specify the filename without a path, the <code>ocnDisplay</code> command creates the file in the directory pointed to by your SKILL Path. To find out what your SKILL path is, type <code>getSkillPath()</code> at the OCEAN prompt.
<code>p_port</code>	Port (previously opened with <code>outfile</code>) through which to append the information to a file. You are responsible for closing the port. See the outfile command for more information.
<code>s_command</code>	<p>Command that was initially used to add the items that are now being displayed.</p> <p>Valid values: Most simulation setup commands. The commands that are supported include <code>design</code>, <code>analysis</code>, <code>tran</code>, <code>ac</code>, <code>dc</code>, <code>noise</code>, <code>resultsDir</code>, <code>temp</code>, <code>option</code>, <code>desVar</code>, <code>path</code>, <code>includeFile</code>, <code>modelFile</code>, <code>stimulusFile</code>, <code>definitionFile</code>, <code>saveOption</code>, <code>envOption</code>, <code>save</code>, <code>converge</code>, <code>ic</code>, <code>forcenode</code>, <code>nodeset</code>, <code>simulator</code>, <code>setup</code>, <code>restore</code>, <code>saveSubckt</code></p>
<code>g_commandArg1</code>	Argument corresponding to the specified command.
<code>g_commandArg2</code>	Additional argument corresponding to the specified command.

Value Returned

<code>t</code>	Displays the information and returns <code>t</code> .
<code>nil</code>	Returns <code>nil</code> and prints an error message if there are problems displaying the information.

Example

```
ocnDisplay( 'optimizeGoal )  
=> t
```

Displays all the `optimizeGoal` information.

```
ocnDisplay( 'analysis 'tran )  
=> t
```

Displays only transient analyses.

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```
ocnDisplay( 'save ' )  
=> t
```

Displays all the keeps.

```
ocnDisplay( ?output myPort 'analysis ' )  
=> t
```

Displays and writes all the analyses to the port named `myPort`.

ocnDspfFile

```
ocnDspfFile(  
    t_dspfFile [ t_dspfFile1 ... t_dspfFileN ]  
)  
=> t_dspfFile(s) / nil
```

Description

Sets the parasitic (dspf, spf) files to be used in a Spectre OCEAN session. You can use this command to specify a list of parasitic files to be included in the control file. You can use `ocnDisplay('dspfFile)` to view the currently active parasitic (dspf, spf) files in an OCEAN session.

Note: This command is applicable for Spectre simulator. For AMS, it works only when Spectre is selected as the solver.

Arguments

<i>t_dspfFile</i>	The name of the parasitic (dspf, spf) file to be included.
<i>t_dspfFile1...t_dspfFileN</i>	The name of the additional parasitic (dspf, spf) files to be included.

Value Returned

<i>t_dspfFile</i>	Lists the names of the parasitic (dspf, spf) files.
<i>nil</i>	Returns <i>nil</i> if there are problems displaying the information.

Example

```
ocnDspfFile("/tmp/file1.dspf" "/tmp/file2.dspf")  
=> ("/tmp/file1.dspf" "/tmp/file2.dspf")
```

Displays the `/tmp/file1.dspf` and `/tmp/file2.dspf` parasitic files to be used for current Spectre OCEAN session.

ocnSpefFile

```
ocnSpefFile(  
    t_SpefFile [ t_SpefFile1 ... t_SpefFileN ]  
)  
=> t_SpecFile(s) / nil
```

Description

Sets the parasitic (spef) files to be used in a Spectre OCEAN session. You can use this command to specify a list of parasitic files to be included in the control file. You can use `ocnDisplay('SpefFile)` to view the currently active parasitic (spef) files in an OCEAN session.

Note: This command is applicable for Spectre simulator. For AMS, it works only when Spectre is selected as the solver.

Arguments

<i>t_SpefFile</i>	The name of the parasitic (spef) file to be included.
<i>t_SpefFile1...t_SpefFileN</i>	The name of the additional parasitic (spef) files to be included.

Value Returned

<i>t_SpefFile</i>	Lists the names of the parasitic (spef) files.
<i>nil</i>	Returns <code>nil</code> if there are problems displaying the information.

Example

```
ocnSpefFile("/tmp/file1.spef" "/tmp/file2.spef")  
=> ("/tmp/file1.spef" "/tmp/file2.spef")
```

Displays the `/tmp/file1.spef` and `/tmp/file2.spef` parasitic files to be used for current Spectre OCEAN session.

ocnPspiceFile

```
ocnPspiceFile(  
    t_PSpiceFile  
    [ t_PSpiceFile1 ... t_PSpiceFileN ]  
)  
=> t_PSpiceFile(s) / nil
```

Description

Sets the PSpice files to be used in a Spectre OCEAN session. Use this command to specify a list of PSpice files to be included in the control file.

Note: This command is applicable for the Spectre simulator. For AMS, it works only when Spectre is selected as the solver.

Arguments

<i>t_PSpiceFile</i>	The name of the PSpice file to be included.
<i>t_PSpiceFile1...t_PSpiceFileN</i>	The name of the additional PSpice files to be included.

Value Returned

<i>t_PSpiceFile</i>	Lists the names of the PSpice files.
<i>nil</i>	Returns <i>nil</i> if there are problems displaying the information.

Example

```
ocnPspiceFile("/tmp/file1.sp" "/tmp/file2.sp")  
=> ("/tmp/file1.sp" "/tmp/file2.sp")
```

Returns the `/tmp/file1.sp` and `/tmp/file2.sp` PSpice files to be used for the current Spectre OCEAN session.

ocnGetAdjustedPath

```
ocnGetAdjustedPath(  
    t_libName  
    t_cellName  
    t_viewName  
    t_netName )  
=> t_adjustedPath / nil
```

Description

Reduces the given hierarchical net path to the shortest hierarchical name that is equivalent to this net.

Arguments

<i>t_libName</i>	Library name of the top cellview of the design.
<i>t_cellName</i>	Cell name of the top cellview of the design.
<i>t_viewName</i>	View name of the top cellview of the design.
<i>t_netName</i>	A single concatenated string for the instance hierarchy with "/" as the hierarchy separator in the string.

Value Returned

<i>t_adjustedPath</i>	The reduced net name. If the net is local to this cell view only, the reduced net name is the same as the provided net name.
<i>nil</i>	Returns <i>nil</i> if there is a problem returning the adjusted path.

Example

```
ocnGetAdjustedPath( "mylib" "test" "schematic" "I7/I3/gnd")  
=> "/gnd"
```

The return value is `"/gnd"` because the `gnd` net is connected from this point up to the top level of hierarchy.

ocnGetInstancesModelName

```
ocnGetInstancesModelName(  
    [ l_instance ]  
)  
=> l_instance / nil
```

Description

This function returns the model name used by the instance in opened simulation results.

Arguments

<i>l_instance</i>	Name of the instance in the simulation result or the schematic.
-------------------	---

Value Returned

<i>l_instance</i>	The list of instance names and models used by instance.
nil	Returns nil if no result is open.

Examples

```
ocnGetInstancesModelName()  
=> (("/I8/Q4" "trpnp")  
    ("/I8/Q3" "trpnp")  
    ("/I8/Q2" "trpnp")  
    ("/I8/Q1" "trnpn")  
    ("/I8/Q0" "trnpn")  
    ("/I8/C0" "capacitor")  
    ("/I2" "isource")  
    ("/I8/M1" "trpmos")  
    ("/I8/M3" "trpmos")  
    ("/I8/M2" "trnmos")  
    ("/I8/M5" "trnmos")  
    ("/R1" "resistor")  
    ("/R0" "resistor")  
    ("/I8/R0" "resistor")  
    ("/V2" "vsource")  
    ("/I1/V2" "vsource"))
```

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```
    ("/I1/V0" "vsource")
)
ocnGetInstancesModelName("/R1")
=> ("/R1" "resistor")

ocnGetInstancesModelName(list("/R1" "/I8/Q1"))
=> ("/R1" "resistor") ("/I8/Q1" "trnnpn")
```

off

```
off(  
    s_command  
    [ g_commandArg1 ] [ g_commandArg2 ]  
)  
=> t / nil
```

Description

Turns off the specified information.

This command is currently available only for the analysis and restore commands. The first argument specifies the command whose information you want to turn off. If you include only this first argument, all the information for the command is turned off. If you supply subsequent arguments, only those particular pieces of information are turned off as opposed to turning off all the information for that command. The information is not deleted and can be used again.

Arguments

<i>s_command</i>	Command that was initially used to add the items that are now being turned off. Valid value: <code>restore</code>
<i>g_commandArg1</i>	Argument corresponding to the specified command.
<i>g_commandArg2</i>	Additional argument corresponding to the specified command.

Value Returned

<code>t</code>	Returns <code>t</code> if the information is turned off.
<code>nil</code>	Returns <code>nil</code> and prints an error message if there are problems turning off the information.

Example

```
off( 'restore )  
=> t
```

Turns off the `restore` command.

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Simulation Commands

```
off( restore 'tran )  
=> t
```

Turns off the transient `restore` command.

option

```
option(  
    [ ?categ s_categ ]  
    s_option1 g_value1 [ s_option2 g_value2 ] ... )  
=> undefined / nil
```

Description

Specifies the values for built-in simulator options. You can specify values for as many options as you want.

Arguments

<i>s_categ</i>	Type of simulator to be used. Valid values: <code>analog</code> if the options are for an analog simulator, <code>digital</code> for a digital simulator, or <code>mixed</code> for a mixed-signal simulator Default value: <code>analog</code>
<i>s_option1</i>	Name of the simulator option.
<i>g_value1</i>	Value for the option.
<i>s_option2</i>	Name of an additional simulator option.
<i>g_value2</i>	Value for the option.

Value Returned

<code>undefined</code>	The return value for this command/function is undefined.
<code>nil</code>	Returns <code>nil</code> and prints an error message if there are problems setting the option.

Example

```
option( 'abstol 1e-10 )
```

Sets the `abstol` option to `1e-10`.

```
option( 'delmax 50n )
```

Sets the `delmax` option to `50n`.

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Simulation Commands

`option()`

Returns the category list for simulation options, including analog, digital, and mixed.

`option(?categ 'analog')`

Returns all the simulator options for the analog simulator currently set. For example, if the set simulator is spectre, it returns the valid simulator options for spectre.

restore

```
restore(  
    s_analysisType  
    t_filename  
)  
=> undefined / nil
```

Description

Tells the simulator to restore the state previously saved to a file with a `store` command.

This command is not available for the Spectre® circuit simulator, with which you can use the `store/restore` options: `readns`, `readforce`, `write`, or `writefinal`.

Note: `Restore` is available for the `cdsSpice` and `hspiceS` simulators.

Arguments

<i>s_analysisType</i>	Type of the analysis. Valid values: <code>dc</code> or <code>tran</code>
<i>t_filename</i>	Name of the file containing the saved state.

Value Returned

<code>undefined</code>	The return value for this command/function is undefined.
<code>nil</code>	Returns <code>nil</code> and prints an error message if there are problems restoring the information.

Example

```
restore( 'dc "./storeFile" )  
=> ./storeFile
```

Initializes the simulator to the state saved in the `storeFile` file.

```
restore( 'tran "./tranStoreFile" )  
=> ./tranStoreFile
```

Initializes the simulator to the state of a transient analysis saved in the `tranStoreFile` file.

resultsDir

```
resultsDir(  
    t_dirName  
)  
=> undefined / nil
```

Description

Specifies the directory where the PSF files (results) are stored.

If you do not specify a directory with this command, the PSF files are placed in `../psf` to the `netlist` directory.

Note: The directory you specify with `resultsDir` is also where the `simulator.out` file is created.

Note: Some simulators are designed to *always* put their results in a specific location. For these simulators, `resultsDir` has no effect. You might use this command when you want to run several simulations using the same design and want to store each set of results in a different location. If this command is not used, the results of an analysis are overwritten with each simulation run.

Arguments

<code>t_dirName</code>	Directory where the PSF files are to be stored.
------------------------	---

Value Returned

<code>undefined</code>	The return value for this command/function is undefined.
<code>nil</code>	Returns <code>nil</code> and prints an error message if there is a problem with that directory.

Example

```
resultsDir("~/simulation/ckt/spectre/schematic/psf")=>  
    "~/simulation/ckt/spectre/schematic/psf"
```

Specifies the `psf` directory as the directory in which to store the PSF files.

```
resultsDir() => "~/simulation/ckt/spectre/schematic/psf"
```

Returns the results directory.

run

```
run(  
  [ ?jobName t_jobName ]  
  [ ?drmsCmd t_drmsCmd ] )  
=> s_jobName / nil  
  
run(  
  [ analysisList ]  
  [ ?jobName t_jobName ]  
  [ ?host t_hostName ]  
  [ ?queue t_queueName ]  
  [ ?startTime t_startTime ]  
  [ ?termTime t_termTime ]  
  [ ?dependentOn t_dependentOn ]  
  [ ?mail t_mailingList ]  
  [ ?block s_block ]  
  [ ?notify s_notifyFlag ]  
  [ ?lsfResourceStr s_lsfResourceStr ]  
  )  
=> s_jobName / nil  
  
run(  
  )  
=> t_dirName / nil  
  
run(  
  s_analysisType1 - s_analysisTypeN  
  )  
=> t_dirName / nil
```

Description

Starts the simulation or specifies a time after which an analysis should start. If distributed processing is not available on the system or is not enabled, the arguments specific to distributed processing (see *Arguments* section below for list of arguments specific to distributed processing) are ignored and the simulation runs locally. If distributed processing is available and is enabled, the environment default values are used if not specified in the `run` command arguments. The environmental default values are stored in the `.cdsenv` file.

Do not use the `run` command to start the parametric analysis. Instead, use the command that is specific to the analysis.

To start	Use this command
parametric analyses	<u>paramRun</u>

Arguments

<i>analysisList</i>	List of analyses to be run with the <code>run</code> command.
<i>s_analysisType1</i>	Name of a prespecified analysis to be simulated.
<i>s_analysisTypeN</i>	Name of another prespecified analysis to be simulated.

The following arguments apply only when the distributed processing mode is enabled:

<i>t_jobName</i>	If the name given is not unique, an integer is appended to create a unique job name.
<i>t_hostName</i>	Name of the host on which to run the analysis. If no host is specified, the system assigns the job to an available host.
<i>t_queueName</i>	Name of the queue. If no queue is defined, the analysis is placed in the default queue.
<i>t_startTime</i>	Desired start time for the job. If dependencies are specified, the job does not start until all dependencies are satisfied.
<i>t_termTime</i>	Termination time for job. If the job has not completed by the specified termination time, the job is aborted.
<i>t_dependentOn</i>	List of jobs on which the specified job is dependent. The job is not started until dependent jobs are completed.
<i>t_mailingList</i>	List of users to be notified when the analysis is complete.
<i>s_block</i>	When <i>s_block</i> is not set to <code>nil</code> , the OCEAN script halts until the job is complete. Default value: <code>nil</code>
<i>s_notifyFlag</i>	When not set to <code>nil</code> , the job completion message is echoed to the OCEAN interactive window. Default value: <code>t</code>
<i>s_lsfResourceStr</i>	An LSF Resource Requirement string to submit a job. It is effective only in the LSF mode.
<i>sgeHardResourceStr</i>	Requirements for hardware resources for the job to be run in the SGE mode.
<i>sgeSoftResourceStr</i>	Requirements for software resources for the job to be run in the SGE mode.
<i>sgePriority</i>	Priority for the job being submitted in the SGE mode.

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Simulation Commands

<i>sgeNoOfProcessors</i>	Number of processors to be used in the SGE mode.
<i>sgeParallelEnvName</i>	Name of the parallel environment to be used in the SGE mode.
<i>t_drmsCmd</i>	<p>A DRMS (Distributed Resource Management System) command, such as a <code>bsub</code> command for LSF or a <code>qsub</code> command for SGE (Sun Grid Engine) used to submit a job. When this argument is used, all other arguments, except <code>?jobName</code> will be ignored. Moreover, it will not be possible to call the OCEAN function <code>wait</code> on the jobs submitted using this argument.</p> <p>To know more about the command option, refer to the section <code>Submitting a Job</code> in the chapter <code>Using the Distributed Processing Option</code> in the <code>Analog Design Environment of the Virtuoso Analog Distributed Processing Option User Guide</code>.</p>

Value Returned

<i>s_jobName</i>	Returns the job name of the job submitted. The job name is based on the <code>jobName</code> argument. If the job name submitted is not unique, a unique identifier is appended to the job name. This value is returned for nonblocking distributed mode.
<i>t_dirName</i>	Returns the name of the directory in which the results are stored. This value is returned for local and blocking distributed modes.
<i>nil</i>	Returns <code>nil</code> and prints an error message if there is an error in the simulation. In this case, look at the <code>yourSimulator.out</code> file for more information. (This file is typically located in the <code>psf</code> directory.)

Example

```
run(?jobName "job1" ?drmsCmd "bsub -q lnx32")
=> s_jobName/nil
```

where `lnx32` is the name of the queue to which the job is submitted.

```
run( )
=> t
```

Starts the simulation.

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Simulation Commands

```
run('tran, 'ac)
```

Runs only the `tran` and `ac` analyses.

```
run('dc)
```

Runs only the `dc` analysis.

```
run( ?jobName ?block "nil")  
=> 'reconFilter
```

Returns a job name of `reconFilter` for the specified job and runs that job if distributed processing is enabled. The job is submitted nonblocking. The job name is returned.

```
run( ?queue "fast" )
```

Submits the current design and enabled analyses as a job on the `fast` queue, assuming that distributed processing is available and enabled.

```
run( ?jobName "job1" ?queue "fast" ?host "menaka" ?startTime "22:59"  
?termTime "23:25" ?mail "preampGroup")
```

Submits the current design and enabled analyses as a jobName `job1` on the `fast` queue host `menaka` with the job start time as `22:59` and termination time as `23:25`. A mail will be sent to `preampGroup` after the job ends.

```
run( ?jobName "job1" ?queue "fast" ?host "menaka" ?lsfResourceStr "mem>500")
```

Submits the current design and enabled analyses as a jobName `job1` on the `fast` queue host `menaka`, if the host has at least 500 MB of RAM memory.

save

```
save (
  [ ?categ s_categ ] s_saveType
  [ t_saveName1 ] ... [ t_saveNameN ]
)
=> undefined / nil
```

Description

Specifies the outputs to be saved and printed during simulation.

When specifying particular outputs with `saveName`, you can include as many outputs as you want. If you want to turn off the default of `save`, 'allv, use the `delete('save)` command.

Arguments

<i>s_categ</i>	Type of simulator to be used. Valid values: <code>analog</code> , <code>digital</code> Default value: <code>analog</code> Note: <code>digital</code> is not available.
<i>s_saveType</i>	Type of outputs to be saved. Valid values: <code>v</code> : Specifies that a list of subsequent net names be saved. <code>i</code> : Specifies that a list of subsequent currents be saved. <code>all</code> : Specifies that all nets and all currents are to be saved. <code>allv</code> : Specifies that all voltages are to be saved. <code>alli</code> : Specifies that all currents are to be saved. Default value: <code>allv</code>
<i>t_saveName1</i>	Name of the net, device, or other object.
<i>t_saveNameN</i>	Name of another net, device, or object.

Value Returned

<i>undefined</i>	The return value for this command/function is undefined.
<i>nil</i>	Returns <code>nil</code> and prints an error message if there is a problem saving the outputs.

Example

```
save( 'v "net34" "net45" )
```

Saves the outputs for `net34` and `net45`.

```
save( 'i "R1" "/Q1/b" )
```

Saves the currents for `R1` and `Q1/b`.

```
save( 'all' )
```

Saves all the nets and currents.

```
save( 'i "q1:b" "r1:p" "mn1:d" )
```

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For the spectre simulator, saves the current through the specified devices.

```
save( ?categ 'analog 'v "/vin" "/vout" )
```

Saves the output for vin and vout.

```
save( 'i "i(q1,b)" "i(r1)" "i(mn1,d)" )
```

For the Cadence-SPIICE circuit simulator, saves the current through the same devices.

saveOpPoint

```
saveOpPoint(  
    t_instName  
    [ ?operatingPoints l_operatingPoints ]  
)  
=> t / nil
```

Description

Specifies the operating point parameters to be saved for a given instance.

Arguments

<i>t_instName</i>	Name of the instance for which the parameters are to be saved.
<i>?operatingPoints l_operatingPoints</i>	List of the operating point parameters.

Values Returned

<i>t</i>	Returns <i>t</i> when the function runs successfully.
<i>nil</i>	Returns <i>nil</i> if there is an error.

Example

```
saveOpPoint( "/I8/Q3" ?operatingPoints "vbe isub betaac gm re" )
```

This example saves the operating point parameters, *vbe isub betaac gm re*, for the instance */I8/Q3*.

saveOption

```
saveOption(  
    [ s_option1 g_optionValue1 ]...[ s_optionN g_optionValueN ]  
)  
=> undefined / nil
```

Description

Specifies save options to be used by the simulator.

You can include as many save options as you want. To include a save option, replace *s_option1* with the name of the desired save option and include another argument to specify the value for the option.

When you use the `saveOption` command without specifying any arguments, the command returns a list of option and value pairs.

Save options vary, depending on the simulator and interface that you are using. If you are using the Spectre® circuit simulator, for example, you can type the following at an OCEAN prompt to see which options you can set with the `saveOption` command:

```
simulator('spectre)  
ocnHelp('saveOption)
```

See the *Virtuoso Spectre Circuit Simulator User Guide* for more information on these options.

Note: The `saveOption` command does not work with socket simulators. If you are using a socket simulator, you must instead specify save options with the `save` command described in [“save”](#) on page 144.

Arguments

<i>s_option1</i>	Save option. The save options that are available depend on which simulator you use. (See the documentation for your simulator.)
<i>g_optionValue1</i>	Value for the save option.
<i>s_optionN</i>	Any subsequent save option. The save options that are available depend on which simulator you use. (See the documentation for your simulator.)
<i>g_optionValueN</i>	Value for the save option.

Value Returned

<i>undefined</i>	The return value for this command/function is undefined.
<i>nil</i>	Returns <i>nil</i> if there are problems specifying options.

Example

```
saveOption( 'save "lvl" 'nestlvl 10 'currents "selected" 'useprobes "yes"  
'subcktprobelvl 2 ?saveahdlvars "all")
```

simulator

```
simulator(  
    s_simulator  
)  
=> s_simulator / nil
```

Description

Starts an OCEAN session and sets the simulator name for that session. The previous session (if any) is closed and all session information is cleared.

Arguments

<i>s_simulator</i>	Name of the simulator.
--------------------	------------------------

Value Returned

<i>s_simulator</i>	Returns the name of the simulator.
nil	Returns <code>nil</code> and prints an error message if the simulator is not registered with the Virtuoso® Analog Design Environment through OASIS. If the simulator is not registered, the simulator from the preceding session is retained.

Example

```
simulator( 'spectre )  
=> spectre
```

Specifies that the Spectre® circuit simulator be used for the session.

```
simulator()  
=> spectre
```

Returns the simulator that you set for the session. If a simulator was not specified, it returns `nil`.

solver

```
solver(  
    s_solver  
)  
=> s_solver / nil
```

Description

Sets a solver for a given AMS OCEAN session. The valid values for solver are `Spectre` and `UltraSim`. You select `Spectre` if you want to use an accurate AMS-Spectre analog engine. You select `UltraSim` if you want to use the AMS-Ultrasim or FastSPICE(UltraSim) solver for a given AMS simulation.

Note: This command is applicable only when `ams` is the simulator.

Arguments

<code>s_solver</code>	Name of the solver.
-----------------------	---------------------

Value Returned

<code>s_solver</code>	Returns the name of the solver.
<code>nil</code>	Returns <code>nil</code> and prints an error message if the specified solver is not registered with the Virtuoso® Analog Design Environment through OASIS. If the solver is not registered, the solver from the preceding session is retained.

Example

```
solver( 'spectre )  
=> spectre
```

Specifies AMS-Spectre as the solver to be used for the current AMS session.

```
solver( 'ultraSim )  
=> ultraSim
```

Specifies AMS-UltraSim (UltraSim FastSPICE) as the solver to be used for the current AMS session.

stimulusFile

```
stimulusFile(  
    t_fileName [ t_fileName2 ... t_fileNameN ]  
    [ ?xlate g_xlate ]  
)  
=> l_fileNames / nil
```

Description

Specifies stimulus files to be used by the simulator.

When the *g_xlate* variable is set to *t*, the schematic net expressions [#net] and instance name expression [\$instance] in the stimulus file are mapped into simulator names before including. When a netlist is specified as the design, this option must be set to *nil*.

Note: This command does not work with socket simulators.

Arguments

<i>t_fileName</i>	The name of the stimulus file to be included.
<i>t_fileName2...t_fileNameN</i>	The names of the additional stimulus files to be included.
<i>g_xlate</i>	If set to <i>t</i> , net and instance expressions are translated to simulator names. The default value of the <i>g_xlate</i> variable is <i>t</i> .

Value Returned

<i>l_fileNames</i>	A list of the stimulus file names is the output if the command is successful
<i>nil</i>	Otherwise <i>nil</i> is returned

Example

```
stimulusFile( "tran.stimulus rf.stimulus" ?xlate nil)  
=> ("tran.stimulus rf.stimulus")
```

Includes *tran.stimulus* and *rf.stimulus* in the simulator input file. No net and instance expressions are translated.

OCEAN Reference

Simulation Commands

```
stimulusFile()  
=> ("tran.stimulus" "rf.stimulus")
```

Returns the `stimulusFile`, if one was set earlier. Otherwise, it returns `nil`.

store

```
store(  
    s_analysisType  
    t_filename  
)  
=> t_filename / nil
```

Description

Requests that the simulator store its node voltages to a file.

You can restore this file in a subsequent simulation to help with convergence or to specify a certain starting point. This command is not available for the Spectre® circuit simulator, with which you can use the store/restore options: `readns`, `readforce`, `write`, or `writefinal`.

Note: `store` is available for the `cdsSpice` and `hspiceS` simulators.

Arguments

<i>s_analysisType</i>	Type of the analysis. Valid values: <code>dc</code> or <code>tran</code>
<i>t_filename</i>	Name of the file in which to store the simulator's node voltages.

Value Returned

<i>t_filename</i>	Returns the filename.
<code>nil</code>	Returns <code>nil</code> and prints an error message if there are problems storing the information to a file.

Example

```
store( 'dc "./storeFile" )  
=> ./storefile
```

Stores the simulator's node voltages in a file named `storeFile` in the current directory.

```
store( 'tran "./tranStoreFile" )  
=> ./transtorefile
```

Stores the node voltages for a transient analysis in a file named `tranStoreFile` in the netlist (design) directory unless a full path is specified.

temp

```
temp(  
    f_tempValue  
)  
=> s_tempValue / nil
```

Description

Specifies the circuit temperature.

Arguments

<i>f_tempValue</i>	Temperature for the circuit.
--------------------	------------------------------

Value Returned

<i>s_tempValue</i>	Returns the temperature specified.
<i>nil</i>	Returns <i>nil</i> and prints an error message if there are problems setting the temperature.

Example

```
temp( 125 )  
=> ?125?  
atof(temp( 125 ))  
=> 125.0
```

Sets the circuit temperature to 125.

```
temp()  
=> 125
```

Gets the value you had set for the circuit temperature. If you have not set a value for the temperature, it returns the default value.

tran

```
tran(  
    g_fromValue  
    g_toValue  
    g_byValue  
)  
=> g_byValue / nil  
  
tran(  
    g_toValue  
)  
=> undefined / nil
```

Description

Specifies a transient analysis with limited options. If other analysis options are needed, use the [analysis](#) command.

To know more about this analysis, see the simulator-specific user guide.

Note: The second instance of the `tran` command is valid only with the spectre simulator.

Arguments

<i>g_fromValue</i>	Starting time for the analysis
<i>g_toValue</i>	Ending time
<i>g_byValue</i>	Increment at which to step through the analysis

Value Returned

<i>undefined</i>	The return value for this command/function is undefined.
<i>nil</i>	Returns <code>nil</code> and prints an error message if the analysis is not specified.

Example

```
tran( 1u)  
=> "1e-06"
```

Specifies a transient analysis to 1u for the Spectre® circuit simulator

```
tran( 0 1u 1n )  
=> "1e-09"
```

Specifies a transient analysis from 0 to 1u by increments of 1n.

vcdFile

```
vcdFile(  
    t_vcdFileName  
)  
=> t_vcdFileName / nil
```

Description

Sets a VCD file for a given AMS or UltraSim OCEAN session. You also need to specify a VCD info file while using this command. You can specify only one VCD file for a session. You may use `ocnDisplay('vcdFile')` to view the currently active VCD file.

Note: This command is applicable for AMS and UltraSim simulators. For AMS, it works only when UltraSim is the solver.

Arguments

<i>t_vcdFileName</i>	The name of the VCD file to be used for session.
----------------------	--

Value Returned

<i>t_vcdFileName</i>	The VCD file name is the output if the command is successful.
<i>nil</i>	Otherwise, <i>nil</i> is returned.

Example

```
vcdFile("/tmp/vcdFile.dat")  
=> "/tmp/vcdFile.dat"
```

Specifies `/tmp/vcdFile.dat` as the VCD file to be used for current AMS-UltraSim OCEAN session.

vcdInfoFile

```
vcdInfoFile(  
    t_vcdInfoFileName  
)  
=> t_vcdInfoFileName / nil
```

Description

Sets a VCD info file for a given AMS or UltraSim OCEAN session when you have set UltraSim as the solver. You also need to specify a VCD file while using this command. You can specify only one VCD info file for a session. You may use `ocnDisplay('vcdInfoFile')` to view the currently active VCD info file.

Note: This command is applicable for AMS and UltraSim simulators. For AMS, it works only when UltraSim is the solver.

Arguments

<i>t_vcdInfoFileName</i>	The name of the VCD info file to be included.
--------------------------	---

Value Returned

<i>t_vcdInfoFileName</i>	The VCD info file name is the output if the command is successful.
<i>nil</i>	Otherwise, <i>nil</i> is returned.

Example

```
vcdInfoFile("/tmp/vcdInfoFile.dat")  
=> "/tmp/vcdInfoFile.dat"
```

Specifies `/tmp/vcdInfoFile.dat` as the VCD file to be used for current AMS-UltraSim OCEAN session.

vecFile

```
vecFile(  
    t_vecFile [ t_vecFile1 ... t_vecFileN ]  
)  
=> t_vecFile(s) / nil
```

Description

Sets the vector files to be used in an AMS or UltraSim OCEAN session. You use the `vecFile` command to specify a list of vector files which go to control file. You may use `ocnDisplay('vecFile)` to view the currently active vector files in an OCEAN session.

Note: This command is applicable for AMS and UltraSim simulators. For AMS, it works only when UltraSim is the solver.

Arguments

<code>t_vecFile</code>	The name of the vector file to be included.
<code>t_vecFile1...t_vecFileN</code>	The names of the additional vector files to be included.

Value Returned

<code>t_vecFile</code>	The names of the vector file(s) are listed if the command is successful.
<code>nil</code>	Otherwise, <code>nil</code> is returned.

Example

```
vecFile("/tmp/vec.dat" "/tmp/vec2.dat")  
=> ("/tmp/vec1.dat" "/tmp/vec2.dat")
```

Specifies `/tmp/vec.dat` and `/tmp/vec.dat2` as the vector files to be used for the current AMS-UltraSim OCEAN session.

hlcheck

```
hlcheck(  
    t_value  
)  
=> t / nil
```

Description

Sets or gets the value of the `hlcheck` option used in the `vec_include` statement in a `netlist`. You may use the `ocnDisplay('hlcheck)` command to view the current value of `hlcheck` in an OCEAN session associated with vector files.

Note: This command is applicable only when one or more vector files are specified in a given 'spectre' OCEAN session.

Arguments

<code>t_value</code>	Value to be set for the <code>hlcheck</code> option. Possible values include "off", "0", and "1". The value "off" disables the <code>hlcheck</code> option in the <code>vec_include</code> statement.
----------------------	---

Value Returned

<code>t</code>	Returns <code>t</code> if the <code>hlcheck</code> option is set with the value supplied as argument
<code>nil</code>	Otherwise, returns <code>nil</code> and an error message is displayed

Example

```
hlcheck( "1" )  
=> t
```

Sets the value of the `hlcheck` option as 1 in the `vec_include` statement

```
hlcheck()  
=> "1"
```

Returns the value of the `hlcheck` option

ocnAmsSetUnlNetlister

```
ocnAmsSetUnlNetlister(  
    )  
=> t / nil
```

Description

Sets the netlister mode to AMS Unified Netlister for a given `ams` OCEAN session.

Arguments

None.

Value Returned

<code>t</code>	Returns <code>t</code> if successful
<code>nil</code>	Returns <code>nil</code> otherwise

Example

```
ocnAmsSetUnlNetlister()  
t
```

Sets the netlister mode to AMS Unified Netlister for the current `ams` simulator session.

Data Access Commands

The data access commands let you open results and select different types of results to analyze. You can get the names and values of signals and components in the selected results, and you can print different types of reports.

In this chapter, you can find information on the following data access commands

[dataTypes](#)

[deleteSubckt](#)

[displaySubckt](#)

[getData](#)

[getResult](#)

[i](#)

[openResults](#)

[outputParams](#)

[outputs](#)

[phaseNoise](#)

[pv](#)

[resultParam](#)

[results](#)

[selectResult](#)

[sp](#)

OCEAN Reference

Data Access Commands

sprobeData

sweepNames

sweepValues

sweepVarValues

v

vswr

zm

zref

dataTypes

```
dataTypes(  
    )  
=> l_dataTypes / nil
```

Description

Returns the list of data types that are used in an analysis previously specified with `selectResult`.

Arguments

None.

Value Returned

l_dataTypes

Returns the list of data types.

nil

Returns *nil* and an error message if the list of datatypes cannot be returned.

Example

```
selectResult( 'dcOpInfo '  
dataTypes() => ("bjt" "capacitor" "isource" "mos2" "resistor" "vsource")
```

Returns the data types used in the selected file, in this case, `dcOpInfo`.

Example 2:

```
selectResult( 'model '  
dataTypes() => ("bjt" "mos2")
```

Returns the data types used in the selected file, in this case, `model`.

deleteSubckt

```
deleteSubckt(  
    t_name  
)  
=> t / nil
```

Description

Deletes the specified subcircuit instance saved using the saveSubckt command.

Arguments

<i>t_name</i>	The name of the subcircuit instance.
---------------	--------------------------------------

Value Returned

<i>t</i>	Returns <i>t</i> if the selected subcircuit instances is deleted.
<i>nil</i>	Returns <i>nil</i> if the name of the specified instance is not correct.

Examples

The following example deletes the subcircuit instance I0.

```
deleteSubckt("/I0")  
=> t
```

displaySubckt

```
displaySubckt(  
    t_args  
    t_outPort  
)  
=> t / nil
```

Description

Prints the subcircuit information to the output file.

Arguments

<i>t_args</i>	The value of this argument should always be <code>nil</code> .
<i>t_outPort</i>	The name of the file to save the subcircuit information. If you do not specify the location with the filename, the file is saved in the current working directory.

Value Returned

<i>t</i>	Returns <code>t</code> if the subcircuit information is printed in the specified output file.
<code>nil</code>	Returns <code>nil</code> if the name of the output file is not specified, or an error occurred.

Examples

The following example prints the subcircuit information in the `subckts.txt` file:

```
fptr = outfile("/home/krajiv/subckts.txt")  
=> port: "/home/krajiv/subckts.txt"  
displaySubckt(nil fptr)  
=> t  
close(fptr)  
=> t
```

getData

```
getData(  
    t_name  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ] )  
=> x_number / o_waveform / nil
```

Description

Returns the number or waveform for the signal name specified.

The type of value returned depends on how the command is used.

Arguments

<i>t_name</i>	Name of the signal.
<i>s_resultName</i>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the selectResult command. The default is the current result selected with the selectResult command.
<i>t_resultsDir</i>	Directory containing the PSF files (results). If you supply this argument, you must also supply the resultName argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the openResults command. The default is the current results directory set by the openResults command.

Value Returned

<i>x_number</i>	Returns an integer simulation result.
<i>o_waveform</i>	Returns a waveform object. A waveform object represents simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>nil</i>	Returns <code>nil</code> and an error message if the value cannot be returned.

Example

```
getData( "/net6" ) => srrWave:25178234
```

Returns the number or waveform for `net6`. In this example, the return value is equivalent to `v("/net6")`.

```
getData( "/V1" ?result 'ac )  
=> srrWave:96879364
```

Returns the number or waveform for `V1`. In this example, the return value is equivalent to:

```
i( "/V1" ?result 'ac ).  
selectResult( 'tran ) =>  
ocnPrint( getData( "net1" ) ) =>
```

OCEAN Reference

Data Access Commands

The `getData("net1")` command passes a waveform to the `ocnPrint` command. The `ocnPrint` command then prints the data for the waveform. In this example, the return value is equivalent to:

```
(v( "net1" )).
```

```
ocnPrint( getData( "net1" ?result 'tran ?resultsDir "./simulation/testcell/
spectre/schematic/psf")
```

Returns a signal on `net1` for the `tran` result stored in the path `./simulation/testcell/spectre/schematic/psf`.

Note: To identify the data type of the value returned by the `getData` command, you can use the `type SKILL` function. For scalar values, the `type` function returns the name of data type. For example, `integer` or `flonum`. For waveforms, it returns `other`.

```
x=getData("/net10")
type(x)
```

The example given above returns `other`.

```
x=ymax(VT("/net10"))
type(x)
```

This will return `flonum`.

getResult

```
getResult (
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]
)
=> o_results / nil
```

Description

Gets the data object for a specified analysis without overriding the status of any previously executed `selectResult()` or `openResults()` commands.

Returns the data object for a particular analysis similar to the `selectResult()` function does. Unlike the `selectResult()` function, all subsequent data access commands will not internally use this information.

Arguments

s_resultName

Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the `selectResult` command. The default is the current result selected with the `selectResult` command.

t_resultsDir

Directory containing the PSF files (results). If you supply this argument, you must also supply the `resultName` argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the `openResults` command. The default is the current results directory set by the `openResults` command.

Value Returned

o_results

Returns the object representing the selected results.

nil

Returns `nil` and an error message if there are problems accessing the analysis.

Example

```
getResult( ?result 'tran )
```

i

```
i(  
    t_component  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
)  
=> o_waveform / nil
```

Description

Returns the current through the specified component.

Arguments

<i>t_component</i>	Name of the component.
<i>s_resultName</i>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the selectResult command. The default is the current result selected with the selectResult command.
<i>t_resultsDir</i>	Directory containing the PSF files (results). If you supply this argument, you must also supply the resultName argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the openResults command. The default is the current results directory set by the openResults command.

Value Returned

<i>o_waveform</i>	Returns a waveform object. A waveform object represents simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>nil</i>	Returns an error message and <i>nil</i> if there is a problem.

Example

```
selectResult( 'tran' )  
i( "/R1" )
```

OCEAN Reference

Data Access Commands

Returns the current through the R1 component.

```
ocnPrint( i( "/R1" ) )
```

Prints the current through the R1 component.

```
ocnPrint( i( "/R1" ?result 'dc ) )
```

Prints the current through the R1 component with respect to the dc swept component.

```
ocnPrint( i( "/R1" ?resultsDir "./test2/psf" ?result 'dc ) )
```

Prints the current through the R1 component with respect to dc for the results from a different run (stored in test2/psf).

ocnHelp

```
ocnHelp(  
    [ ?output t_filename | p_port ]  
    [ s_command ]  
)  
=> t / nil
```

Description

Provides online help for the specified command.

If no command is specified, provides information about how to use help and provides the different categories of information contained in the help library. If you provide a filename as the `?output` argument, the `ocnHelp` command opens the file and writes the information to it. If you provide a port (the return value of the `SKILL outfile` command), the `ocnHelp` command appends the information to the file that is represented by the port. If you do not specify `?output`, the output goes to standard out (stdout).

Arguments

<i>t_filename</i>	File in which to write the information. The <code>ocnHelp</code> command opens the file, writes to the file, and closes the file. If you specify the filename without a path, the <code>ocnHelp</code> command creates the file in the directory pointed to by your SKILL Path. To find out what your SKILL path is, type <code>getSkillPath()</code> at the OCEAN prompt.
<i>p_port</i>	Port (previously opened with <code>outfile</code>) through which to append the information to a file. You are responsible for closing the port. See the outfile command for more information.
<i>s_command</i>	Command for which you want help.

Value Returned

<i>t</i>	Displays the online help and returns <i>t</i> .
<i>nil</i>	Returns <i>nil</i> and an error message if help cannot be displayed.

Example

```
ocnHelp()  
=> t
```

Displays information about using online help.

```
ocnHelp( 'analysis '  
=> t
```

Displays help for the `analysis` command.

```
ocnHelp( ?output "helpInfo" )  
=> t
```

Writes information about using online help to a file named `helpInfo`.

```
simulator('spectre)  
ocnHelp('envOptions)
```

Displays a list of environment options that can be set for a simulator. First, set the simulator and then run the `ocnHelp` command.

ocnResetResults

```
ocnResetResults(  
    )  
=> t
```

Description

Unsets the results opened by the `openResults` command. Use this command to return to the state that existed prior to using the `openResults` command.

Arguments

None.

Value Returned

<code>t</code>	Resets the results and returns <code>t</code> .
----------------	---

Example

<code>getResult(?result 'tran)</code>	Returns <code>nil</code> when no results have been opened.
<code>openResults("./psf")</code>	Makes <code>getResult</code> return valid object.
<code>ocnResetResults()</code>	Resets the results opened by <code>openResults</code> and makes <code>getResult</code> return <code>nil</code> .

openResults

```
openResults(  
    s_jobName | t_dirName  
    [ g_enableCalcExpressions ]  
)  
=> t_dirName / nil
```

Description

Opens simulation results stored in PSF files or opens the results from a specified job, depending on which parameter is called.

When `openResults` passes a symbol, it interprets the value as a job name and opens the results for the specified job. `s_jobName` is a job name and is defined when a `run` command is issued.

When `openResults` passes a text string, it opens simulation results stored in PSF files in the specified directory. The results must have been created by a previous simulation run through OCEAN or the Virtuoso® Analog Design Environment. The directory must contain a file called `logFile` and might contain a file called `runObjFile`. When you perform tasks in the design environment, the `runObjFile` is created. Otherwise, only `logFile` is created.

If you want to find out which results are currently open, you can use `openResults` with no argument. The directory for the results that are currently open is returned.

Note: If you run a successful simulation with distributed processing disabled, the results are automatically opened for you. Also, a job name is generated by every analysis, even if distributed processing is not enabled.

Arguments

<i>s_jobName</i>	The name of a distributed process job. <i>s_jobName</i> is a job name and is defined when a <code>run</code> command is issued.
<i>t_dirName</i>	The directory containing the PSF files.
<i>g_enableCalcExpressions</i>	<p>An optional argument, which when set to <code>t</code>, allows the evaluation of Calculator expressions. For this argument to work, the directory mentioned in <i>t_dirName</i> must be a <code>psf</code> directory and must contain <code>runObjFile</code>.</p> <p>The default value for this argument is <code>t</code>.</p>

Value Returned

<i>t_dirName</i>	The directory containing the PSF files.
<code>nil</code>	Returns <code>nil</code> and an error message if there are problems opening the results.

Example

```
openResults( "./simulation/opamp/spectre/schematic/psf" )  
=> "./simulation/opamp/spectre/schematic/psf"
```

Opens the results in the `psf` directory within the specified path.

```
openResults( "./psf" )  
=> psf
```

Opens the results in the `psf` directory in the current working directory.

```
openResults( "./psf" t )  
=> psf
```

Opens the results in the `psf` directory in the current working directory. It also allows the evaluation of the Calculator expression.

outputParams

```
outputParams(  
    t_compType  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
)  
=> l_outputParams / nil
```

Description

Returns the list of output parameters for the specified component.

You can use the [dataTypes](#) command to get the list of components for a particular set of results.

Note: You can use any of the parameters in *outputParams* as the second argument to the [pv](#) command.

Arguments

<code>t_compType</code>	Name of a component.
<code>?result s_resultName</code>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the <code>selectResult</code> command. The default is the current result selected with the <code>selectResult</code> command.
<code>?resultsDir t_resultsDir</code>	Directory containing the PSF files (results). If you supply this argument, you must also supply the <code>resultName</code> argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the <code>openResults</code> command. The default is the current results directory set by the <code>openResults</code> command.

Value Returned

<code>l_outputParams</code>	Returns the list of parameters.
<code>nil</code>	Returns <code>nil</code> and an error message if there are no associated parameters or if the specified component (<code>compType</code>) does not exist.

Example

```
selectResult( 'dcOpInfo ' )  
dataTypes() => ("bjt" "capacitor" "isource" "mos2" "resistor" "vsource")  
outputParams( "bjt" )
```

Selects the `dcOpInfo` results, returns the list of components for these results, and returns the list of output parameters for the `bjt` component.

```
outputParams("bjt" ?result 'dcOpInfo ?resultsDir "/VADE615/simulation/ampTest/  
spectre/schematic/psf")
```

Returns a list of output parameters for the `bjt` component for `dcOpInfo` (dc analysis with save dc operating point) results stored at the location `./psf`.

outputs

```
outputs(  
  [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
  [ ?type t_signalType ]  
)  
=> l_outputs / nil
```

Description

Returns the names of the outputs whose results are stored for an analysis. You can plot these outputs or use them in calculations.

Arguments

`?result s_resultName` Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the `selectResult` command. The default is the current result selected with the `selectResult` command.

`? resultDir t_resultsDir` Directory containing the PSF files (results). If you supply this argument, you must also supply the `resultName` argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the `openResults` command. The default is the current results directory set by the `openResults` command.

`?type t_signalType` Data type of the signal.

Value Returned

`l_outputs` Returns the list of outputs.

`nil` Returns `nil` and an error message if there are problems returning the names of the stored outputs.

Example

```
outputs()  
=> ( "net13" "net16" "net18" )
```

Returns the names of the outputs for the PSF file selected with `selectResult`.

```
outputs( ?type "V" )
```

Returns all the signal names that are node voltages. The `dataType (signal)` returns the data type of the signal.

```
outputs(?result "tran" ?resultsDir "./psf")  
=> ( "net11" "net15" "net17" )
```

Returns the names of the outputs for the tran results stored at the location `./psf`.

phaseNoise

```
phaseNoise(  
    g_harmonic S_signalResultName  
    [ ?result s_noiseResultName [ ?resultsDir t_resultsDir ] ]  
)  
=> o_waveform / nil
```

Description

Returns the phase noise waveform which is calculated using information from two PSF data files.

This command should be run on the results of the Spectre pss-pnoise analysis.

Arguments

<i>g_harmonic</i>	List of harmonic frequencies.
<i>?result S_signalResultName</i>	Name of the result that stores the signal waveform. Use the <code>results()</code> command to obtain the list results.
<i>?resultsDir s_noiseResultName</i>	Name of the result that stores the "positive output signal" and "negative output signal" noise waveforms. When specified, this argument will only be used internally and will not alter the current result which was set by the <code>selectResult</code> command. The default is the current result selected with the <code>selectResult</code> command.
<i>t_resultsDir</i>	Directory containing the PSF files (results). If you supply this argument, you must also supply the <code>S_noiseResultName</code> argument. Both the <code>S_signalResultName</code> and <code>S_noiseResultName</code> arguments are read from this directory. When specified, this argument will only be used internally and will not alter the current results directory which was set by the <code>openResults</code> command. The default is the current results directory set by the <code>openResults</code> command.

Value Returned

<i>o_waveform</i>	Waveform representing the phase noise.
<i>nil</i>	Returns <code>nil</code> if there is an error.

Example

```
plot(phaseNoise(0 "pss-fd.pss"))  
phaseNoise(1 "pss_fd" ?result "pnoise" ?resultsDir `./PSF")
```


pv

```
pv(  
    t_name  
    t_param  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
)  
=> g_value / nil
```

Description

Returns the value of the specified component parameter. You can use the [outputParams](#) command to get the list of parameters for a particular component.

Arguments

t_name Name of the node or component.

t_param Name of the parameter.

?result s_resultName

Results from an analysis. When specified, this argument will only be used internally and will not alter the current result that was set using the `selectResult` command. The default is the current result selected using the `selectResult` command.

Note: To get the correct value of the variables while running parametric analysis, use the `designParamVals` value for the `resultName` argument.

?resultsDir t_resultsDir

Directory containing the PSF files (results). If you supply this argument, you must also supply the `resultName` argument. When specified, this argument will only be used internally and will not alter the current results directory that was set using the `openResults` command. The default is the current results directory set using the `openResults` command.

Value Returned

g_value Returns the requested parameter value.

nil Returns *nil* and prints an error message.

Example

```
selectResult( 'dcOpInfo' )  
pv( "/I0/M1" "vds" )
```

Returns the value of the `vds` parameter for the `I0/M1` component.

```
pv( "/I0/M1" "vds" ?resultsDir "/VADE/simulation/ampTest/spectre/schematic/test2/  
psf" )
```

Returns the value of the `vds` parameter for the `I0/M1` component. These values are read from the results directory, `/VADE/simulation/ampTest/spectre/schematic/test2/psf`.

```
pv( "/I0/M1" "vds" ?result "dcOpInfo" ?resultDir "/VADE/simulation/ampTest/  
spectre/schematic/test1/psf")
```

OCEAN Reference

Data Access Commands

Returns the value of the `vds` parameter for the `I0/M1` component. These values are read from the `dcOpInfo` results saved in the results directory, `/VADE/simulation/ampTest/spectre/schematic/test1/psf`.

```
pv("top-level" "CAP" ?result "designParamVals")
```

Returns the value of the `CAP` variable for the top-level hierarchy in the design. These values are read from the default results directory.

resultParam

```
resultParam(  
    S_propertyName  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
)  
=> L_value / nil
```

Description

Returns the value of a header property from the selected result data.

Arguments

s_propertyName Name of the parameter

?result *s_resultName*

Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the selectResult command. The default is the current result selected with the selectResult command.

?resultsDir *t_resultsDir*

Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the selectResult command. The default is the current result selected with the selectResult command.

Value Returned

L_value Value of the parameter. The data type depends on the data type of the parameter.

nil Returns nil and an error message if there are problems returning the results.

Example

```
resultParam("positive output signal" ?result "pnoise.pss")  
=> "pif"  
resultParam("negative output signal" ?result "pnoise.pss")  
=> "0"
```

OCEAN Reference

Data Access Commands

Returns the name of the positive and negative output signals from PSS-noise analysis result. In this case, the data type of the returned value is a string.

```
resultParam("port1.r.value" ?result "sp")  
=> 40.0  
resultParam("port2.r.value" ?result "sp")  
=> 40.0
```

Returns the reference impedance of the ports in a two-port network from the S-parameter analysis result. In this case, the data type of the returned value is a floating point number.

```
resultParam("positive output signal" ?result "pnoise.pss" ?resultsDir "./psf")  
=> "0"
```

Returns the names of the positive output signals from the PSS-noise analysis results stored at the location ./psf.

results

```
results(  
    [ ?resultsDir t_resultsDir ]  
)  
=> l_results / nil
```

Description

Returns a list of the type of results that can be selected.

Arguments

`?resultsDir t_resultsDir`

Directory containing the PSF files (results). When specified, this argument will only be used internally and will not alter the current results directory which was set by the `openResults` command. The default is the current results directory set by the `openResults` command.

Value Returned

`l_results`

Returns the list of result types.

`nil`

Returns `nil` and an error message if there are problems returning the results.

Example

```
results()  
=> ( dc tran ac )
```

Returns the list of results available.

```
results( ?resultsDir "./psf" )
```

Returns a list of results stored at the location `./psf`.

saveSubckt

```
saveSubckt (
    t_name
    [ ?voltage g_voltage ]
    [ ?current g_current ]
    [ ?power g_power ]
    [ ?vDepth s_vDepth ]
    [ ?iDepth s_iDepth ]
    [ ?pwrDepth s_pwrDepth ]
    [ ?compress g_compress ]
    [ ?filterRC g_filterRC ]
    [ ?ports g_ports ]
    [ ?userOptions g_userOptions ]
)
=> t / nil
```

Description

Saves and modifies the specified subcircuit instances and signals.

OCEAN Reference

Data Access Commands

Arguments

<code>t_name</code>	The name of the subcircuit instance.
<code>?voltage g_voltage</code>	Specifies whether you want to save the voltage for the subcircuit.
<code>?current g_current</code>	Specifies whether you want to save the current for the subcircuit.
<code>?power g_power</code>	Specifies whether you want to save the power signals for the subcircuit.
<code>?vDepth s_vDepth</code>	The hierarchy level to which you want to save the voltage signal for the subcircuit. If not specified, voltage for all the levels of hierarchy are saved.
<code>?iDepth s_iDepth</code>	The hierarchy level to which you want to save the current signal for the subcircuit. If not specified, current for all the levels of hierarchy are saved.
<code>?pwrDepth s_pwrDepth</code>	The hierarchy level to which you want to save the power signal for the subcircuit. If not specified, power signals for all the levels of hierarchy are saved.
<code>?compress g_compress</code>	Specifies whether you want to reduce the size of the output file. When enabled, the spectre simulator saves the data for a signal only when the value of that signal changes.
<code>?filterRC g_filterRC</code>	Specifies whether to filter out the nodes that are connected only to parasitic elements from the output signal list.
<code>?ports g_ports</code>	Specifies whether to save the output port information for the specified subcircuit.
<code>?userOptions g_userOptions</code>	Specify the other save options that you want to define for the signal.

Value Returned

<code>t</code>	Returns <code>t</code> if the subcircuit instance is saved.
<code>nil</code>	Returns <code>nil</code> if the name of the specified instance is not correct.

Examples

Example 1

The following example saves the voltage for five levels and current for two levels of hierarchy for the subcircuit I0.

```
saveSubckt("/I0" ?voltage t ?current t ?vDepth "5" ?iDepth "2")  
=> t
```

Example 2

The following example saves the voltage for two levels and power signals for one level of hierarchy for the subcircuit I1.

```
saveSubckt("/I1" ?voltage t ?power t ?vDepth "2" ?pwrDepth "1")  
=> t
```

Example 3

The following example saves the voltage for two levels and power signals for one level of hierarchy for the subcircuit I1, along with the port information. The output signals are compressed.

```
saveSubckt("/I1" ?voltage t ?power t ?vDepth "2" ?pwrDepth "1" ?port t ?compress t)  
=> t
```

selectResult

```
selectResult(  
    S_resultsName  
    [ n_sweepValue ]  
)  
=> o_results / nil
```

Description

Selects the results from a particular analysis whose data you want to examine.

The argument that you supply to this command is a data type representing the particular type of analysis results you want. All subsequent data access commands use the information specified with `selectResult`.

Note: Refer to the [results](#) command to get the list of analysis results that you can select.

Arguments

<i>S_resultsName</i>	Results from an analysis.
<i>n_sweepValue</i>	The sweep value you wish to select for an analysis.

Value Returned

<i>o_results</i>	Returns the object representing the selected results.
<i>nil</i>	Returns <code>nil</code> and an error message if there are problems selecting the analysis.

Example

```
selectResult( 'tran' )
```

Selects the results for a transient analysis.

```
sweepValues(3.0 3.333333 3.666667 4.0 4.333333 4.666667 5.0 )  
selectResult("tran" "3.333333")
```

The `sweepValues` command prints a list of sweep values.

The `selectResult` command selects a specific value for a transient analysis.

```
selectResult( 'tran' )
```

OCEAN Reference

Data Access Commands

Selects the results for a transient analysis.

```
paramAnalysis("supply" ?start 3 ?stop 5 ?step 1.0/3)
paramRun("supply")
selectResult(( 'tran car( sweepValues() )
```

Selects the data corresponding to the first parametric run.

Note: `selectResult('tran)` would select the entire family of parametric data.

sp

```
sp(  
  x_iIndex  
  x_jIndex  
  [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
)  
=> o_waveform / nil
```

Description

Returns S-parameters for N port networks.

This command should be run on the results of the Spectre sp (S-parameter) analysis.

Arguments

<code>x_iIndex</code>	The <i>i</i> th index of the coefficient in the scattering matrix.
<code>x_jIndex</code>	The <i>j</i> th index of the coefficient in the scattering matrix.
<code>?result</code> <code>s_resultName</code>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the selectResult command. The default is the current result selected with the selectResult command.



When working with a maestro cellview, you must specify this argument.

<code>?resultsDir</code> <code>t_resultsDir</code>	Directory containing the PSF files (results). If you supply this argument, you must also supply the resultName argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the openResults command. The default is the current results directory set by the openResults command.
---	---

Value Returned

<code>o_waveform</code>	Waveform object representing the S-parameter.
<code>nil</code>	Returns <code>nil</code> if there is an error.

Example

For an OCEAN script:

```
selectResult('sp')
s21 = sp(2 1)
s12 = sp(1 2)
plot(s21 s12)
;Plots S-parameters s21 and s12 for results of S-parameter(sp) analysis stored in
the psf of the last run simulation
```

For an output expression in a maestro cellview:

```
sp(1 1 ?result 'sp )
;Returns the S-parameter for results of S-parameter(sp) analysis stored in the
results for each point
```

sprobeData

```
sprobeData(  
    t_ana  
    t_sprobeInst  
    [ ?type t_type ]  
    [ ?dataDir t_dataDir ]  
)  
=> o_waveform / nil
```

Description

Returns the waveform for the specified analysis and parameter type of the given probe instance.

<i>t_ana</i>	Specifies the type of analysis. Valid values: <ul style="list-style-type: none">■ 'sp_probe – Returns the waveforms of "S1", "S2", "Z1" or "Z2" as specified by the t_type argument.■ 'sp_sprobe\StabIndex – Returns the waveform of stability index (StabIndex)
<i>t_sprobeInst</i>	Specifies the name of the probe instance.
<i>?type t_type</i>	One or more strings representing the names of the type. Valid values: <ul style="list-style-type: none">■ "S1", "S2", "Z1" or "Z2" (Scattering parameters)■ "StabIndex" (Stability Index)
<i>?dataDir</i> <i>t_dataDir</i>	Directory containing the PSF file. By default, it uses the current results directory that is set by the openResults SKILL command.

OCEAN Reference

Data Access Commands

Value Returned

<i>o_waveform</i>	Waveform object that displays a series of points on a grid. <code>srrWave:XXXXX</code> is used as the waveform object identifier.
<code>nil</code>	Returns <code>nil</code> if there is an error and a waveform cannot be returned.

Example

The following example gets the waveform of parameter S1 of probe instance "I0"

```
sprobeData('sp_sprobe "I0" ?type "S1")
```

The following example gets the waveform of parameter StabIndex of probe instance "I0"

```
sprobeData('sp_sprobe\~StabIndex "I0" ?type "StabIndex")
```

sweepNames

```
sweepNames (
  [ o_waveForm ]
  [ ?result s_resultName [ ?resultsDir t_resultsDir ] ] )
=> l_sweepName / nil
```

Description

Returns the names of all the sweep variables for either a supplied waveform, a currently selected result (via `selectResult()`) or a specified result.

Arguments

<code>o_waveForm</code>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code>). When this argument is used, the <code>t_resultsDir</code> and <code>s_resultName</code> arguments are ignored.
<code>?result s_resultName</code>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the <code>selectResult</code> command. The default is the current result selected with the <code>selectResult</code> command.
<code>?resultsDir t_resultsDir</code>	Directory containing the PSF files (results). If you supply this argument, you must also supply the <code>resultName</code> argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the <code>openResults</code> command. The default is the current results directory set by the <code>openResults</code> command.

Value Returned

<code>l_sweepName</code>	Returns a list of the sweep names.
<code>nil</code>	Returns <code>nil</code> and prints an error message if the sweep names cannot be returned.

Example

```
selectResult('tran)
sweepNames()
=> ( "TEMPDC" "time" )
```

Returns a list of sweep variables for the selected results. In this case, the return values indicate that the data was swept over temperature and time.

```
sweepNames(?result 'ac)
=> ( "TEMPDC" "freq" )
sweepNames()
=> ( "TEMPDC" "time" )
```

OCEAN Reference

Data Access Commands

```
w = VT("/vout")
sweepNames( w )
=> ( "r" "time")
```

Returns the sweep variables for the waveform `w`.

```
sweepNames(?result 'ac ?resultsDir "./test/psf")
=> ("TEMPDC" "freq")
```

Returns the sweep variables for the results of the ac analysis stored at the location `./test/psf`.

sweepValues

```
sweepValues(  
    [ o_waveForm ]  
)  
=> l_sweepValues / nil
```

Description

Returns the list of sweep values of the outermost sweep variable of either the selected results or the supplied waveform. This command is particularly useful for parametric analyses.

Arguments

<i>o_waveForm</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>l_sweepValues</i>	Returns the list of sweep values.
<i>nil</i>	Returns <code>nil</code> and an error message if the list of sweep values cannot be returned.

Example

```
sweepValues()  
=> ( -50 -15 20 55 90.0 )
```

Returns a list of sweep values for the selected results. In this case, the return values indicate the temperature over which the data was swept.

```
w = VT("/vout")  
sweepNames( w )  
=> ( "r" "time" )  
sweepValues( w )  
=> ( 2000 4000 6000 )
```

Returns a list of sweep values for the wave *w*. In this case, the return values indicate the resistance over which the data was swept.

sweepVarValues

```
sweepVarValues(  
    [ t_varName ]  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
)  
=> l_sweepName / nil
```

Description

Returns the list of sweep values for a particular swept variable name. This command is particularly useful for parametric analyses.

Arguments

<i>t_varName</i>	Name of the specific variable from which the values are retrieved.
?result <i>s_resultName</i>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the selectResult command. The default is the current result selected with the selectResult command.
?resultsDir <i>t_resultsDir</i>	Directory containing the PSF files (results). If you supply this argument, you must also supply the resultName argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the openResults command. The default is the current results directory set by the openResults command.

Value Returned

<i>l_sweepValues</i>	Returns the list of sweep values.
nil	Returns nil and an error message if the list of sweep values cannot be returned.

Example

```
selectResult('tran)
```

OCEAN Reference

Data Access Commands

```
sweepNames()  
=> ("TEMPDC" "Vsupply" "time")  
  
sweepVarValues("TEMPDC")  
=> (0 32)  
  
sweepNames(?result 'ac)  
=> ("TEMPDC" "Vsupply" "freq")  
  
sweepVarValues("Vsupply" ?result 'ac)  
=> (5 12 15)  
  
sweepNames(?result 'ac ?resultsDir "./simResult/psf")  
=> ("TEMPDC" "freq")  
  
sweepVarValues("TEMPDC" ?result 'ac ?resultsDir "./simResult/psf")  
=> (-15 20 55)
```

OCEAN Reference

Data Access Commands

V

```
v(  
    t_net  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
    )  
=> o_waveform / nil
```

Description

Returns the voltage of the specified net.

Arguments

<code>t_net</code>	Name of the net.
<code>?result s_resultName</code>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the <code>selectResult</code> command. The default is the current result selected with the <code>selectResult</code> command.
<code>?resultsDir t_resultsDir</code>	Directory containing the PSF files (results). If you supply this argument, you must also supply the <code>resultName</code> argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the <code>openResults</code> command. The default is the current results directory set by the <code>openResults</code> command.

Value Returned

<code>o_waveform</code>	Returns a waveform object. A waveform object represents simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code>).
<code>nil</code>	Returns an error message and <code>nil</code> if there is a problem.

Example

```
selectResult('tran')
v( "/net56" )
```

Returns the voltage for `net56`.

```
ocnPrint( v( "/net56" ) )
```

Prints tabular information representing the voltage for `net56`.

```
ocnPrint( v( "net5" ?result 'dc' ) )
```

Prints the voltage of `net5` with respect to the `dc` swept component.

```
ocnPrint( v( "net5" ?resultsDir "./test2/psf" ?result 'dc' ) )
```

Prints the voltage of `net5` with respect to `dc` for the results from a different run (stored in `test2/psf`).

VSWR

```
vswr(  
    x_index  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
)  
=> o_waveform / nil
```

Description

Computes the voltage standing wave ratio.

This function is a higher level wrapper for the OCEAN expression

$$(1 + \text{mag}(s(x_index, x_index))) / (1 - \text{mag}(s(x_index, x_index)))$$

This command should be run on the results of the Spectre sp (S-parameter) analysis.

Arguments

<code>x_index</code>	Index of the port.
<code>?result s_resultName</code>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the <code>selectResult</code> command. The default is the current result selected with the <code>selectResult</code> command.
<code>?resultsDir t_resultsDir</code>	Directory containing the PSF files (results). If you supply this argument, you must also supply the <code>resultName</code> argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the <code>openResults</code> command. The default is the current results directory set by the <code>openResults</code> command.

Value Returned

<code>o_waveform</code>	Waveform object representing the voltage standing wave ratio.
<code>nil</code>	Returns an error message or <code>nil</code> if there is a problem.

Example

```
plot( vswr(2) )  
vswr1 = vswr(1 ?result "sp" ?resultsDir "./simResult/psf")
```

Returns the voltage standing wave ratio value at port 1 for the results of S-parameter(sp) analysis stored at the location `./simResult/psf`.

zm

```
zm (
  x_index
  [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]
)
=> o_waveform / nil
```

Description

Computes the port input impedance.

The `zm` function is computed in terms of the S-parameters and the reference impedance. This function is a higher level wrapper for the OCEAN expression

```
(1 + s( x_index x_index )) / (1 - s( x_index x_index ))
* or( zref( x_index ) 50)
```

This command should be run on the results of the Spectre `sp` (S-parameter) analysis.

Arguments

<code>x_index</code>	Index of the port.
<code>?result s_resultName</code>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the <code>selectResult</code> command. The default is the current result selected with the <code>selectResult</code> command.
<code>?resultsDir t_resultsDir</code>	Directory containing the PSF files (results). If you supply this argument, you must also supply the <code>resultName</code> argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the <code>openResults</code> command. The default is the current results directory set by the <code>openResults</code> command.

Value Returned

<code>o_waveform</code>	Waveform object representing the port input impedance.
<code>nil</code>	Returns an error message and <code>nil</code> if there is a problem.

Example

```
plot(zm(2))  
zm1 = zm(1 ?result "sp" ?resultsDir "./simResult/psf")
```

Returns input impedance at port 1 for results of S-parameter (sp) analysis stored at the location `./simResult/psf`.

zref

```
zref(  
    x_portIndex  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
)  
=> f_impedance / nil
```

Description

Returns the reference impedance for an N-port network.

This command should be run on the results of the Spectre sp (S-parameter) analysis.

Arguments

<i>x_portIndex</i>	Index of the port.
<i>?result s_resultName</i>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the selectResult command. The default is the current result selected with the selectResult command.
<i>?resultsDir t_resultsDir</i>	Directory containing the PSF files (results). If you supply this argument, you must also supply the resultName argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the openResults command. The default is the current results directory set by the openResults command.

Value Returned

<i>f_impedance</i>	Reference impedance.
<i>nil</i>	Returns an error message and <i>nil</i> if there is a problem.

Example

```
Zref = zref(2)  
zref1 = zref(1 ?result "sp" ?resultsDir "./simResult/psf")
```

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Data Access Commands

Returns the reference impedance at port 1 for the results of S-parameter(sp) analysis stored at the location `./simResult/psf`.

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Data Access Commands

Plotting and Printing Commands

This chapter contains information on the following plotting and printing commands:

- [addSubwindow](#)
- [addSubwindowTitle](#)
- [addTitle](#)
- [addWaveLabel](#)
- [addWindowLabel](#)
- [clearAll](#)
- [clearSubwindow](#)
- [currentSubwindow](#)
- [currentWindow](#)
- [dbCompressionPlot](#)
- [dcmatchSummary](#)
- [deleteSubwindow](#)
- [deleteWaveform](#)
- [displayMode](#)
- [getAsciiWave](#)
- [graphicsOff](#)
- [graphicsOn](#)
- [hardCopy](#)
- [hardCopyOptions](#)
- [ip3Plot](#)

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Plotting and Printing Commands

- [newWindow](#)
- [noiseSummary](#)
- [ocnGenNoiseSummary](#)
- [ocnPrint](#)
- [ocnPrintTMIReliabilityResults](#)
- [ocnPrintTMIResultTypeList](#)
- [ocnSetAttrib](#)
- [ocnWriteLsspToFile](#)
- [ocnYvsYplot](#)
- [plot](#)
- [plotStyle](#)
- [printGraph](#)
- [pzFrequencyAndRealFilter](#)
- [pzPlot](#)
- [pzSummary](#)
- [removeLabel](#)
- [report](#)
- [saveGraphImage](#)
- [xLimit](#)
- [yLimit](#)

This chapter also includes a topic, [PI](#).

addSubwindow

```
addSubwindow()  
=> x_subwindowID / nil
```

Description

Adds a subwindow to the current Waveform window and returns the number for the new subwindow, which is found in the upper right corner.

Arguments

None.

Value Returned

<i>x_subwindowID</i>	Returns the window ID of the new subwindow.
<i>nil</i>	Returns <i>nil</i> and an error message if there is no current Waveform window.

Example

```
addSubwindow()  
=>3
```

Adds a new subwindow to the Waveform window.

addSubwindowTitle

```
addSubwindowTitle(  
    x_windowtitle  
)  
=> t / nil
```

Description

Adds a title to the current subwindow in the active window. The current subwindow is defined using the `currentSubwindow` command.

Arguments

<i>x_windowtitle</i>	User-defined title for the subwindow.
----------------------	---------------------------------------

Value Returned

<i>t</i>	The user-supplied name of the current subwindow.
<i>nil</i>	Returns <code>nil</code> if the title is not created.

Example

```
addSubwindowTitle( "waveform 2")  
=> t
```

Adds the title `waveform 2` to the selected subwindow.

addTitle

```
addTitle(  
    x_windowtitle  
)  
=> t / nil
```

Description

Adds a title to the current active OCEAN window. The current window is defined using the `currentWindow` command.

Arguments

<i>x_windowtitle</i>	User-defined title for the window.
----------------------	------------------------------------

Value Returned

<i>t</i>	The user-supplied name of the current window.
<i>nil</i>	Returns <i>nil</i> if the title is not created.

Example

```
addTitle( "waveform 1" )  
=> t
```

Adds the title `waveform 1` to the selected window.

addWaveLabel

```
addWaveLabel(  
    x_waveIndex  
    l_location  
    t_label  
    [ ?textOffset g_textOffset ]  
    [ ?color x_color ]  
    [ ?justify t_justify ]  
    [ ?fontStyle t_fontStyle ]  
    [ ?height x_height ]  
    [ ?orient t_orient ]  
    [ ?drafting g_drafting ]  
    [ ?overBar g_overbar ] )  
=> s_labelId / nil
```

Description

Attaches a label to the specified waveform curve in the current subwindow.

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Arguments

<i>x_waveIndex</i>	Integer identifying the waveform curve.
<i>l_location</i>	List of two waveform coordinates that describe the location for the label.
<i>t_label</i>	Label for the waveform.
<i>g_textOffset</i>	Boolean that specifies whether to place a marker or label. If set to <code>t</code> , a marker is placed. If set to <code>nil</code> , a label is placed. Default value: <code>nil</code> .
<i>x_color</i>	Label color specified as an index in the technology file. Default value: 10
<i>t_justify</i>	Justification, which is specified as "upperLeft", "centerLeft", "lowerLeft", "upperCenter", "centerCenter", "lowerCenter", "upperRight", "centerRight", or "lowerRight". Default value: "lowerLeft"
<i>t_fontStyle</i>	Font style, which is specified as "euroStyle", "gothic", "math", "roman", "script", "stick", "fixed", "swedish", "raster", or "milSpec". Default value: the font style of the current subwindow
<i>x_height</i>	Height of the font. Default value: the font height of the current subwindow
<i>t_orient</i>	Orientation of the text, specified as either "R0" or "R90". Default value: "R0"
<i>g_drafting</i>	Boolean that specifies whether the label stays backwards or upside-down. If set to <code>t</code> , a backwards or upside-down label is displayed in a readable form. If set to <code>nil</code> , a backwards or upside-down label stays the way it is. Default value: <code>t</code>
<i>g_overbar</i>	Boolean that specifies whether underscores in labels are displayed as overbars. If set to <code>t</code> , underscores in labels are displayed as overbars. If set to <code>nil</code> , underbars are displayed as underbars. Default value: <code>nil</code>

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Plotting and Printing Commands

Value Returned

<code>s_labelId</code>	Returns an identification number for the waveform label.
<code>nil</code>	Returns <code>nil</code> if there is an error.

Examples

```
addWaveLabel( 1 list( 0 0.5 ) "R5 = " )
```

Attaches the "R5 = " label to the specified coordinates on waveform curve 1.

```
addWaveLabel( 2 list( 0 0.5 ) "R_6 = " ?textOffset 0:20 ?justify "lowerCenter"  
?fontStyle "roman" ?height 10 ?orient "R20" ?drafting t ?overbar t)
```

Attaches the label "R6 = " to the specified coordinates on waveform curve. The label specifications are as follows: Justification – `lowerCenter`, Font Style – `roman`, Font Height – 10, and Orientation – `R20`.

The label will be displayed in a readable form. The underscore in the label will be displayed as an overbar.

Additional Information

Note the following points:

- The valid label location ranges between absolute co-ordinates (0, 0) on X-axis and (1,1) on Y-axis (upper and lower bound inclusive).
- The valid marker location ranges between data co-ordinates defined by X-axis and Y-axis limits (upper and lower bound inclusive).

Case1:

```
addWaveLabel(1 list( -0.5 -0.5 ) "Label 1" ?textOffset nil)
```

The following error message appears when the specified label location (`-0.5 0.5`) is outside of the defined boundary limits of label.

The location specified for placing a label on the graph is invalid. Specify a valid label location that ranges between absolute coordinates (0,0) on X-axis and (1,1) on Y-axis (upper and lower bounds inclusive).

Case 2:

```
addWaveLabel(1 list( 80MHz -0.5 ) "Marker 1" ?textOffset t)
```

The following error message appears when the specified marker location (`80MHz -0.5`) is outside of the X- and Y-axis limits of the graph to be plotted.

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Plotting and Printing Commands

The location specified for placing a marker on the graph is invalid. Specify a valid marker location that ranges between data coordinates '(0,-1)' on X-axis and '(10000,1)' on Y-axis (upper and lower bounds inclusive).

addWindowLabel

```
addWindowLabel(  
    l_location  
    t_label  
)  
=> s_labelId / nil
```

Description

Displays a label in the current subwindow. The location for the label is specified with a list of two numbers between 0 and 1.

Arguments

<i>l_location</i>	List of two waveform coordinates that describe the location for the label. Valid values: 0 through 1
<i>t_label</i>	Label for the waveform.

Value Returned

<i>s_labelId</i>	Returns an identification number for the subwindow label.
<i>nil</i>	Returns <i>nil</i> if there is an error.

Example

```
label = addWindowLabel( list( 0.75 0.75 ) "test" )
```

Adds the `test` label to the current subwindow at the specified coordinates and stores the label identification number in `label`.

clearAll

```
clearAll()  
=> t / nil
```

Description

Erases the contents of the current Waveform window and deletes the waveforms, title, date stamp, and labels stored in internal memory.

Arguments

None.

Value Returned

<code>t</code>	Returns <code>t</code> if the waveform information is deleted.
<code>nil</code>	Returns <code>nil</code> and an error message if there is no current Waveform window.

Example

```
clearAll()  
=> t
```

Erases the contents of the current Waveform window.

clearSubwindow

```
clearSubwindow()  
=> t / nil
```

Description

Erases the contents of the current subwindow.

Arguments

None.

Value Returned

<code>t</code>	Returns <code>t</code> if the contents of the subwindow are erased.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
clearSubwindow()  
=> t
```

Erases the contents of the current subwindow.

currentSubwindow

```
currentSubwindow(  
    [ ?x_subwindow x_subwindow ]  
)  
=> t / nil
```

Description

Sets *x_subwindow* as the current subwindow.

Arguments

?x_subwindow x_subwindow

(Optional) Number of the subwindow, found in the upper right corner, that is to become the current subwindow.

Value Returned

t

Returns *t* when the subwindow is set to *x_subwindow*. If you do not specify any argument in this function, it returns the current subwindow number.

nil

If no subwindow exists.

Example

```
currentSubwindow( 2 )
```

Sets subwindow 2 as the current subwindow.

currentWindow

```
currentWindow(  
    w_windowId  
)  
=> w_windowId / nil
```

Description

Specifies *w_windowId* as the current Waveform window.

Arguments

<i>w_windowId</i>	Waveform window ID.
-------------------	---------------------

Value Returned

<i>w_windowId</i>	Returns the current Waveform window ID.
<i>nil</i>	Returns <i>nil</i> and an error if the current window cannot be set.

Example

```
currentWindow( window(2) )
```

This example specifies window 2 as the current Waveform window.

```
currentWindow()
```

This example returns the current waveform window. For example, if the current waveform window is 4, this command returns the following:

```
window:4
```

dbCompressionPlot

```
dbCompressionPlot(  
    o_wave  
    x_harmonic  
    x_extrapolationPoint  
    [ ?compression x_compression ]  
)  
=> t / nil
```

Description

Plots the *n*th compression point plot. The *x_compression* argument is optional and defaults to 1 for 1dB compression, if omitted.

This command should be run on the results of the Spectre swept pss analysis.

Arguments

<i>o_wave</i>	The waveform for which to plot the compression.
<i>x_harmonic</i>	Harmonic frequency index.
<i>x_extrapolationPoint</i>	The extrapolation point.
?compression	The amount of dB compression.
<i>x_compression</i>	Default value: 1

Value Returned

<i>t</i>	Returns <i>t</i> if the point is plotted
<i>nil</i>	returns <i>nil</i> if there was an error

Example

```
dbCompressionPlot(v("/Pif") 2 -25)
```

Plots a 1 dB compression point plot for the waveform *v("/Pif")*.

```
dbCompressionPlot(v("/Pif") 2 -25 ?compression 3)
```

Plots a 3 dB compression point plot for the waveform *v("/Pif")*.

dcmatchSummary

```
dcmatchSummary(  
    [ ?resultsDir t_resultsDir ]  
    [ ?result S_resultName ]  
    [ ?output t_fileName | p_port ]  
    [ ?paramValues ln_paramValues ]  
    [ ?deviceType ls_deviceType ]  
    [ ?variations ls_variations ]  
    [ ?includeInst lt_includeInst ]  
    [ ?excludeInst lt_excludeInst ]  
    [ ?truncateData n_truncateData ]  
    [ ?truncateType s_truncateType ]  
    [ ?sortType ls_sortType ]  
)  
=> t_fileName / p_port / nil
```

Description

Prints a report showing the mismatch contribution of each component in a circuit. If you specify a directory with `resultsDir`, it is equivalent to temporarily using the `openResults` command. The `dcmatchSummary` command prints the results for that directory and resets the `openResults` command to its previous setting. If you specify a particular result with `resultName`, it is equivalent to temporarily using the `selectResult` command on the specified results. The `dcmatchSummary` command prints the results and resets the `selectResult` command to its previous setting.

This command should be run on the results of the Spectre `dcmatch` analysis.

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Arguments

<code>?resultsDir</code> <code>t_resultsDir</code>	The directory containing the dcmatch-analysis results.
<code>?results</code> <code>S_resultName</code>	Results from an analysis for which you want to print the dcmatchSummary report.
<code>?output t_filename</code>	File in which to write the information. The dcmatchSummary command opens the file, writes to the file and closes the file. If you specify the filename without a path, the dcmatchSummary command creates the file in the directory pointed to by your SKILL Path. To find out what your SKILL path is, type <code>getSkillPath()</code> at the OCEAN prompt.
<code>?output p_port</code>	Port (previously opened with <code>outfile</code>) through which to append the information to a file. You are responsible for closing the port. See the outfile command for more information.
<code>?paramValues</code> <code>ln_paramValues</code>	List of values for swept parameters at which the dcmatchSummary is to be printed. In case there is just one swept parameter the value can be specified as is.
<code>?deviceType</code> <code>ls_deviceType</code>	List of device type strings to be included. Valid values are a list of strings or 'all' or a single device name. Default value is 'all.
<code>?variations</code> <code>ls_variations</code>	An association list containing the device name and the associated variations to print. You can also specify the value 'all to print all available variations for a device. Default value is 'all. For Example: '(("bsim3v3" ("sigmaOut" "sigmaVth")) ("resistor" ("sigmaOut"))
<code>?includeInst</code> <code>lt_includeInst</code>	List of instance name strings to definitely include in the dcmatchSummary.
<code>?excludeInst</code> <code>lt_excludeInst</code>	List of instance name strings to exclude in the dcmatchSummary.
<code>?truncateData</code> <code>x_truncateData</code>	Specifies a number that the truncateType argument uses to define the components for which information is to be printed.

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`?truncateType`
`s_truncateType`

Specifies the method that is used to limit the data being included in the report

Valid values:

- 'top - Saves information for the number of components specified with truncateData. The components with the highest contributions are saved. Sample value for truncateData: 10
- 'relative - Saves information for all components that have a higher contribution than truncateData * maximum. Where maximum is the maximum contribution among all the devices of a given type. Sample value for truncateData: 1.9n
- 'absolute - Saves information for all the components in the selected set whose contribution are more than truncateData. Sample value for truncateData: 0.1
- 'none - Saves information for all the components. Sample value for truncateData: Not required

`?sortType`
`ls_sortType`

Specifies how the printed results are to be sorted. The valid values are nil, 'name, 'output.

Value Returned

`t_fileName`

Returns the name of the port.

`p_port`

Returns the name of the file.

`nil`

Returns `nil` and an error message if the summary cannot be printed.

Example

```
dcmatchSummary( ?result 'dcmatch-mine )
```

Prints a report for non-swept DC-Mismatch analysis.

```
dcmatchSummary( ?resultsDir "/usr/simulation/lowpass/spectre/schematic" ?result 'dcmatch)
```

Prints a report for non-swept DC-Mismatch analysis for the results from a different run (stored in the schematic directory).

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```
dcmatchSummary( ?resultsDir "/usr/simulation/lowpass/spectre/schematic" ?result  
'dcmatch ?paramValues `(25) )
```

Prints a report for swept DC-Mismatch analysis at swept parameter value of 25.

```
dcmatchSummary( ?result dcmatch-mine ?output "./summary.out")
```

Prints a report for non-swept DC-Mismatch analysis in the output file `summary.out`.

```
dcmatchSummary( ?paramValues 25 ?deviceType "bsim3v3" ?variations '("bsim3v3"  
("sigmaOut "sigmaVth" )))
```

Prints a report for swept DC-Mismatch analysis at swept parameter value of 25 for `bsim3v3` `deviceType` and `sigmaOut` and `sigmaVth` variations.

```
dcmatchSummary( ?paramValues 25 ?truncateType 'top ?truncateData 1)
```

Prints a report for swept DC-Mismatch analysis at swept parameter value of 25 printing only the component having the highest contribution.

```
dcmatchSummary( ?paramValues 25 ?sortType 'name )
```

Prints a report for swept DC-Mismatch analysis at swept parameter value of 25 sorted on name.

deleteSubwindow

```
deleteSubwindow()  
=> t / nil
```

Description

Deletes the current subwindow from the current Waveform window.

Arguments

None.

Value Returned

<code>t</code>	Returns <code>t</code> if the current subwindow is deleted.
<code>nil</code>	Returns <code>nil</code> and an error message if there is no current subwindow.

Example

```
deleteSubwindow()  
=> t
```

Deletes the current subwindow from the Waveform window.

deleteWaveform

```
deleteWaveform(  
    { x_index | all_string }  
)  
=> t / nil
```

Description

Deletes the specified waveform curve or all the waveform curves from the current subwindow of a Waveform window.

Arguments

<i>x_index</i>	Integer identifying a particular waveform curve.
<i>all_string</i>	The string "all" specifying that all waveform curves are to be deleted.

Value Returned

<i>t</i>	Returns <i>t</i> if the curves are deleted.
<i>nil</i>	Returns <i>nil</i> and an error message if the curves are not deleted.

Example

```
deleteWaveform( '1 '  
=> t
```

Deletes waveform 1 from the current subwindow.

```
deleteWaveform( "all" )  
=> t
```

Deletes all the curves from the current subwindow.

displayMode

```
displayMode(  
    t_mode  
)  
=> t / nil
```

Description

Sets the display mode of the current subwindow.

Arguments

<i>t_mode</i>	String representing the display mode for the subwindow. Valid values: <code>strip</code> , <code>composite</code> , or <code>smith</code> . Note: This also works if a plot is not open.
---------------	---

Value Returned

<i>t</i>	Returns <i>t</i> when the display mode of the subwindow is set.
<i>nil</i>	Returns <i>nil</i> and an error message if the display mode cannot be set.

Example

```
displayMode( "composite" )  
=> t
```

Sets the current subwindow to display in `composite` mode.

getAsciiWave

```
getAsciiWave(  
    t_filename  
    x_column  
    x_yColumn  
    [ ?xskip x_x_skip ]  
    [ ?yskip x_yskip ]  
    [ ?formatFloat g_formatFloat ]  
    [ ?xName t_xName ]  
    [ ?xUnits t_xUnits ]  
    [ ?yName t_yName ]  
    [ ?yUnits t_yUnits ]  
)  
=> o_wave / nil
```

Description

Reads in an ASCII file of data and generates a waveform object from the specified data. The X-axis data must be real numbers. The Y-axis data can be real or complex values. Complex values are represented as `(real imag)` or `complex(real imag)`. This function skips blank lines and comment lines. Comments are defined as lines beginning with a semicolon.

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Arguments

<i>t_filename</i>	The name of the Ascii file to be read in.
<i>x_xColumn</i>	The column in the data file that contains the X-axis data.
<i>x_yColumn</i>	The column in the data file that contains the Y-axis data.
<i>?xskip x_xskip</i>	The number of lines to skip in the X column.
<i>?yskip x_yskip</i>	The number of lines to skip in the Y column.
<i>?formatFloat</i> <i>g_formatFloat</i>	A boolean when set to <i>t</i> converts the integer data into float values. Default value: <i>nil</i> .
<i>?xName t_xName</i>	The name of the X-axis.
<i>?xUnits t_xUnits</i>	The units for the X-axis.
<i>?yName t_yName</i>	The name of the Y-axis.
<i>?yUnits t_yUnits</i>	The units for the Y-axis.

Value Returned

<i>o_wave</i>	The waveform object.
<i>nil</i>	Returns <i>nil</i> if the function fails.

Example

```
getAsciiWave("~/mydatafile.txt" 1 2 )  
=> srrWave:32538648
```

Reads in an ascii file `~/mydatafile.txt`, which has x-axis data in the first column and y-axis data in the second column, and returns a waveform object.

```
getAsciiWave("~/mydatafile.txt" 1 2 ?xskip 1 ?yskip 2)  
=> srrWave:32538656
```

Reads in an ascii file `~/mydatafile.txt`, which has x-axis data in the first column and y-axis data in the second column and skips 1 line in the `x_xcolumn` and 2 lines in the `y_ycolumn`, and returns a waveform object.

```
getAsciiWave("/vout_tran_xy.csv" 1 2 ?xskip 1 ?yskip 1 ?formatFloat nil ?xName  
"Time" ?xUnits "Secs" ?yName "V(Out)" ?yUnits "V")
```

Reads in an ascii file, `vout_tran_xy.csv`, which has x-axis data in the first column and y-axis data in the second column, skips 1 line in the `x_xcolumn` and 2 lines in the `y_ycolumn`,

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x- and y-axis names are `Time` and `V(out)`, and x-and y-axis units are `Secs` and `V` respectively.

graphicsOff

```
graphicsOff()  
=> t / nil
```

Description

Disables the redrawing of the current Waveform window.

You might use this command to freeze the Waveform window display, send several plots to the window, and then unfreeze the window to display all the plots at once.

Arguments

None.

Value Returned

<code>t</code>	Returns <code>t</code> if redrawing is disabled.
<code>nil</code>	Returns <code>nil</code> if there is an error, such as there is no current Waveform window.

Example

```
graphicsOff()  
=> t
```

Disables the redrawing of the Waveform window.

graphicsOn

```
graphicsOn()  
=> t / nil
```

Description

Enables the redrawing of the current Waveform window.

Arguments

None.

Value Returned

<code>t</code>	Returns <code>t</code> if redrawing is enabled.
<code>nil</code>	Returns <code>nil</code> if there is an error, such as there is no current Waveform window.

Example

```
graphicsOn()  
=> t
```

Enables the redrawing of the current Waveform window.

hardCopy

```
hardCopy(  
    w_windowId  
)  
=> t / nil
```

Description

Sends a Waveform window plot to a printer or a file. To plot to a printer specify a printer name using the `?hcPrinterName` argument of the `hardCopyOptions` command. To plot to a file, specify a file name using the `?hcOutputFile` argument of the `hardCopyOptions` command.

Note: You must first set any plotting options with the `hardCopyOptions` command.

Arguments

<code>w_windowId</code>	The window ID of the waveform window whose plot is to be sent to a printer or a file. The default value is the window ID of the current window.
-------------------------	---

Value Returned

<code>t</code>	Returns <code>t</code> if successful.
<code>nil</code>	Returns <code>nil</code> if there is an error.

Example

```
hardCopy()  
=> t
```

Sends a waveform plot to the printer or to a file.

```
w = newWindow()  
plot(v("/vout"))  
hardCopy(w)
```

Sends the waveform plot of `w` to the printer or to a file.

hardCopyOptions

```
hardCopyOptions(  
  [ ?hcCopyNum x_hcCopyNum ]  
  [ ?hcOffsetHeight x_hcOffsetHeight ]  
  [ ?hcOffsetWidth x_hcOffsetWidth ]  
  [ ?hcOrientation s_hcOrientation ]  
  [ ?hcOutputFile g_hcOutputFile ]  
  [ ?hcPrinterName s_hcPrinterName ]  
  [ ?hcTmpDir t_hcTmpDir ]  
  [ ?hcPaperSize s_hcPaperSize ]  
  [ ?hcMakeExactCopy g_hcMakeExactCopy ]  
  [ ?hcQuality x_hcQuality ]  
  [ ?hcOptimizeForWindows g_hcOptimizeForWindows ]  
  [ ?hcImageWidth x_hcImageWidth ]  
  [ ?hcImageHeight x_hcImageHeight ]  
  [ ?hcImageSizeUnits s_hcImageSizeUnits ]  
  [ ?hcImageResolution x_ImageResolution ]  
  [ ?hcResolutionUnits s_hcResolutionUnits ]  
  [ ?hcImageAspectRatio x_hcImageAspectRatio ]  
  [ ?hcUseExistingBackground g_hcUseExistingBackground ]  
  [ ?hcDisplayTitle g_hcDisplayTitle ]  
  [ ?hcDisplayLegend g_hcDisplayLegend ]  
  [ ?hcDisplayAxes g_hcDisplayAxes ]  
  [ ?hcDisplayGrids g_hcDisplayGrids ]  
  [ ?hcSaveEachSubwindowSeparately g_hcSaveEachSubwindowSeparately ]  
)  
=> g_value / nil
```

Description

Sets the graph window hardcopy plotting options.

The option takes effect for any graph window or subwindow that is opened after the option is set.

Arguments

<code>?hcCopyNum x_hcCopyNum</code>	The number of copies to plot. Valid values: any positive integer Default value: 1
-------------------------------------	---

OCEAN Reference

Plotting and Printing Commands

`?hcOffsetHeight`
`x_hcOffsetHeight`

The vertical margin.

Valid values: any positive integer

Default value: 0

`?hcOffsetWidth`
`x_hcOffsetWidth`

The horizontal margin.

Valid values: any positive integer

Default value: 0

`?hcOrientation`
`s_hcOrientation`

The plot orientation.

Note: This option works only when you print a graph window and does not work when you save the window to a graph file.

Valid values: 'portrait, 'landscape,
'automatic

Default value: 'automatic

`?hcOutputFile`
`g_hcOutputFile`

Name of the output file. The output file can be created in one of the following file formats:

- BMP – Windows Device Independent Bitmap (.bmp)
- PNG – Portable Network Graphics(.png)
- PS – PostScript (.ps)
- TIFF – Tagged Image File Format (.tif)
- TIFF – Tagged Image File Format (.tif)
- EPS – Encapsulated Post Script (.eps)
- PDF – Portable Document Format (.pdf)
- PPM – Portable PixMap File (.ppm)
- JPG – Joint Photographic Experts Group (.jpg)
- SVG – Scalable Vector Graphics (.svg)
- XPM – X PixMap (.xpm)

Valid values: a string or nil

Default value: nil

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Plotting and Printing Commands

<code>?hcPrinterName</code> <code>s_hcPrinterName</code>	<p>The name of the printer.</p> <p>Valid values: a string or <code>nil</code></p> <p>Default value: <code>nil</code></p>
<code>?hcTmpDir</code> <code>t_hcTmpDir</code>	<p>The name of a temporary directory to be used for scratch space.</p> <p>Valid values: name of a temporary directory</p> <p>Default value: <code>" /usr/tmp "</code></p>
<code>?hcPaperSize</code> <code>s_hcPaperSize</code>	<p>The paper size. The available paper sizes are— letter, legal, executive, folio, ledger, tabloid, a0, a1, a2, a3, a4, a5, a6, a7, a8, a9, b0, b1, b2, b3, b4, b5, b6, b7, b8, b9, b10, c5e, comm10e, dle.</p> <p>Default value: <code>a4</code></p>
<code>?hcMakeExactCopy</code> <code>g_hcMakeExactCopy</code>	<p>Saves the exact copy of all subwindows. Only <code>?hcQuality</code> and <code>?hcOutputFile</code> arguments work with this option. This option does not work for the <code>eps</code> file format.</p> <p>Valid values: <code>t</code> or <code>nil</code></p> <p>Default value: <code>nil</code></p>
<code>?hcQuality</code> <code>x_hcQuality</code>	<p>Modifies the quality of the image. This option works only for the <code>.jpeg</code> file format. This option does not work for the <code>eps</code> file format.</p> <p>Valid values: 20 to 100%</p> <p>Default value: 85</p>
<code>?hcOptimizeForWindows</code> <code>g_hcOptimizeForWindows</code>	<p>Enables the image to be imported in the Microsoft office application. This option is available when you select the image type as Encapsulated PostScript (*<code>.eps</code>). This option simplifies the image output so that it can be ready by Microsoft Office 2003 and 2007 applications</p> <p>Valid values: <code>t</code> or <code>nil</code></p> <p>Default value: <code>t</code></p>

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Plotting and Printing Commands

<code>?hcImageWidth</code> <code>x_hcImageWidth</code>	<p>Sets the width of the image.</p> <p>Valid values: Any positive integer value.</p> <p>Default value: 800 pixels</p>
<code>?hcImageHeight</code> <code>x_hcImageHeight</code>	<p>Sets the height of the image</p> <p>Valid values: Any positive integer value.</p> <p>Default value: 600 pixels</p>
<code>?hcImageSizeUnits</code> <code>s_hcImageSizeUnits</code>	<p>Specifies the unit for image size (height and width)</p> <p>Valid values: inch, cm, mm, picas, pixels, and points</p> <p>Default value: pixels</p>
<code>?hcImageResolution</code> <code>x_hcImageResolution</code>	<p>Sets the image resolution. This option works only for the bmp, jpeg, png, ppm, tif, and xpm file formats. It does not work for eps, pdf, and svg file formats.</p> <p>Valid values: Any positive integer value.</p> <p>Default value: 96</p>
<code>?hcResolutionUnits</code> <code>s_hcResolutionUnits</code>	<p>Sets the units for image resolution. This option works only for the bmp, jpeg, png, ppm, tif, and xpm file formats. It does not work for eps, pdf, and svg file formats.</p> <p>Valid values: pixels/cm and pixels/in</p> <p>Default value: pixels/in</p>
<code>?hcImageAspectRatio</code> <code>g_hcImageAspectRatio</code>	<p>Enables the aspect ratio, which is the ratio of the width of the image to its height.</p> <p>Valid values: <code>t</code> or <code>nil</code></p> <p>Default value: <code>nil</code></p>
<code>?hcUseExistingBackground</code> <code>d</code> <code>g_hcUseExistingBackground</code> <code>nd</code>	<p>Enables to use the existing background in the graph image.</p> <p>Valid values: <code>t</code> or <code>nil</code></p> <p>Default value: <code>nil</code></p>

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<code>?hcDisplayTitle</code> <code>g_hcDisplayTitle</code>	Displays the trace title in the graph image. Valid values: <code>t</code> or <code>nil</code> Default value: <code>t</code>
<code>?hcDisplayLegend</code> <code>g_hcDisplayLegend</code>	Displays the trace legend in the graph image. Valid values: <code>t</code> or <code>nil</code> Default value: <code>t</code>
<code>?hcDisplayAxes</code> <code>g_hcDisplayAxes</code>	Displays the axes in the graph image. Valid values: <code>t</code> or <code>nil</code> Default value: <code>t</code>
<code>?hcDisplayGrids</code> <code>g_hcDisplayGrids</code>	Displays the grids in the graph image. Valid values: <code>t</code> or <code>nil</code> Default value: <code>t</code>
<code>?hcSaveEachSubWindowSeparately</code> <code>g_hcSaveEachSubwindowSeparately</code>	Saves all subwindows in a graph to a single file or multiple files. Valid values: <code>t</code> (multiple files) or <code>nil</code> (single file) Default value: <code>t</code>

Value Returned

<code>g_value</code>	Returns the new value of the option.
<code>nil</code>	Returns <code>nil</code> if there is an error.

Example

```
hardCopyOptions( ?hcCopyNum 1 )
```

Plots one copy of the window or subwindow.

```
hardCopyOptions(?hcCopyNum 3 ?hcOutputFile "myOutFile.bmp")
```

Plots three copies of the window or subwindow and sends them to the file `myOutFile.bmp`.

ip3Plot

```
ip3Plot(  
    o_wave  
    x_sigHarmonic  
    x_refHarmonic  
    x_extrapolationPoint  
)  
=> t / nil
```

Description

Plots the IP3 curves.

This command should be run on the results of the Spectre swept pss and pac analysis.

Refer to the “Simulating Mixers” chapter of the *Virtuoso Spectre Circuit Simulator RF Analysis User Guide* for more information on ip3Plot.

Arguments

<code>o_wave</code>	Waveform for which to plot the ip3.
<code>x_sigHarmonic</code>	Index of the third order harmonic.
<code>x_refHarmonic</code>	Index of the first order (fundamental) harmonic.
<code>x_extrapolationPoint</code>	Extrapolation point.

Value Returned

<code>t</code>	Returns <code>t</code> if the curves are plotted.
<code>nil</code>	Returns <code>nil</code> if there is an error.

Example

```
ip3Plot(v("/net28") 47 45 -25)
```


newWindow

```
newWindow()  
=> w_windowID / nil
```

Description

Creates a new Waveform window and returns the window ID.

Arguments

None.

Value Returned

<i>w_windowID</i>	Returns the window ID of the new Waveform window.
<i>nil</i>	Returns <i>nil</i> and an error message if the new Waveform window cannot be created.

Example

```
newWindow()  
=> window:3
```

Creates a new Waveform window that is numbered 3 in the upper right corner.

noiseSummary

```
noiseSummary(  
    s_type  
    [ ?result s_resultName [ ?resultsDir t_resultsDir ] ]  
    [ ?frequency f_frequency ]  
    [ ?weight f_weight ]  
    [ ?output t_fileName | p_port ]  
    [ ?noiseUnit t_noiseUnit ]  
    [ ?truncateData x_truncateData ]  
    [ ?truncateType s_truncateType ]  
    [ ?digits x_digits ]  
    [ ?percentDecimals x_percentDecimals ]  
    [ ?from f_from ]  
    [ ?to f_to ]  
    [ ?deviceType ls_deviceType ]  
    [ ?weightFile t_weightFile ]  
    [ ?paramValues ls_paramValues ]  
    [ ?hierLevel x_hierLevel ]  
    [ ?sort ls_sort ]  
    [ ?includeInsts ls_includeInsts ]  
    [ ?excludeInsts ls_excludeInsts ]  
    [ ?combineIteratedInsts g_combineIteratedInsts ]  
    [ ?suffixNotation t_suffixNotation ]  
    [ ?writeRCnet g_writeRCnet ]  
)  
=> t / nil
```

Description

Prints a report showing the noise contribution of each component in a circuit.

This command should be run on the results of the Spectre noise analysis.

OCEAN Reference

Plotting and Printing Commands

Arguments

<i>s_type</i>	Type of noise-analysis results for which to print the report. Valid values: <i>spot</i> , to specify noise at a particular frequency, or <i>integrated</i> , to specify noise integrated over a frequency range.
<i>?result s_resultName</i>	Results from an analysis. When specified, this argument will only be used internally and will not alter the current result which was set by the <code>selectResult</code> command. The default is the current result selected with the <code>selectResult</code> command. Note: While trying to get the noise summary output for multiple datasets, in case the current dataset is not a noise dataset, an error message is displayed. To avoid this, specify the <i>?result s_resultName</i> argument explicitly while using this function.
<i>?resultsDir t_resultsDir</i>	Directory containing the PSF files (results). If you supply this argument, you must also supply the <code>resultName</code> argument. When specified, this argument will only be used internally and will not alter the current results directory which was set by the <code>openResults</code> command. The default is the current results directory set by the <code>openResults</code> command.
<i>?frequency f_frequency</i>	Frequency value of interest.
<i>?weight f_weight</i>	Waveform representing the function with which the integral is weighted. Default value: 1 . 0

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Plotting and Printing Commands

?output *t_fileName* | The type of output:
p_port

- File in which to write the information. The `noiseSummary` command opens the file, writes to the file, and closes the file. If you specify the filename without a path, the `noiseSummary` command creates the file in the directory pointed to by your SKILL Path. To find out what your SKILL path is, type `getSkillPath()` at the OCEAN prompt.
- Port (previously opened with `outfile`) through which to append the information to a file. You are responsible for closing the port. See the [outfile](#) command for more information.

?noiseUnit
t_noiseUnit

Specifies the type of noise unit to be saved.

Valid values:

- "V^2" for V^2
or
"V" for V
- "A^2" for A^2
or
"A" for A

?truncateData
x_truncateData

Specifies a number that the `truncateType` argument uses to define the components for which information is to be printed.

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Plotting and Printing Commands

?truncateType
s_truncateType

Specifies the method that is used to limit the data being included in the report.

Valid values:

- 'top' - Saves information for the number of components specified with `truncateData`. The components with the highest contributions are saved. Sample value: 10
- 'level' - Prints components which have noise contribution higher than that specified by `?truncateData`. Sample value: 10u
- 'relative' - Prints components which have noise contribution (percent) higher than that specified by `?truncateData`. Sample value: .1
- 'none' - Saves information for all the components.

?digits *x_digits*

Number of significant digits with which the contributors are printed.

?percentDecimals
x_percentDecimals

Number of decimals printed for any relative contribution.

?from *f_from*

For integrated noise, the start value for frequency.

?to *f_to*

For integrated noise, the end value for frequency.

?deviceType
ls_deviceType

List of device type strings to be included.

Valid values: a list of strings or 'all'

?weightFile
t_weightFile

Absolute or relative path of the file that contains information about weights. This data is used to compute weighted noise. If the values are provided for both `parameters`, `weight` and `weightFile`, the value for `weight` gets precedence.

?paramValues
ls_paramValues

List of values where each value co-relates to a specific sweep variable name. This field must be used when the data is parametric. The order of this list must coincide with the list returned by the `sweepNames` function excluding the frequency variable.

?hierLevel
x_hierlevel

Specifies the hierarchy level up to which the noise summary needs to be computed.

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Plotting and Printing Commands

<code>?sort</code> <i>ls_sort</i>	<p>Determines the order of the report according to the specified symbol categories. Valid values:</p> <ul style="list-style-type: none">■ <code>'individual'</code>: Sorts the report from the largest noise contributor to the smallest.■ <code>'composite'</code>: Sorts the report by the total noise contribution of each device. Each device entry contains the percentage of the noise contribution from this device and the noise contribution from each of its contributors.■ <code>'name'</code>: Produces the same format as composite noise but sorts it alphabetically by device instance name.
<code>?includeInsts</code> <i>ls_includeInsts</i>	<p>List of strings containing instances to be included.</p> <p>Valid values: a list of strings or <code>'all'</code>.</p>
<code>?excludeInsts</code> <i>ls_excludeInsts</i>	<p>List of strings containing instances to be excluded.</p> <p>Valid values: a list of strings or <code>'none'</code>.</p>
<code>?combineIteratedInsts</code> <i>g_combineIteratedInsts</i>	<p>Combines the noise contributions of iterated instances to one contributor.</p> <p>Valid values: <code>t</code> or <code>nil</code></p> <p>Default value: <code>nil</code></p>
<code>?suffixNotation</code> <i>t_suffixNotation</i>	<p>Changes the notation of the noise contribution value for the data output to the specified value. For example, <code>3.36916e-05</code>, is shown as <code>33.6916u</code>.</p> <p>Default value: <code>nil</code></p>
<code>?writeRCnet</code> <i>t_writeRCnet</i>	<p>Prints the information about parasitic resistors and their values for each physical wire net in the noise summary results. This provides users the information to diagnose the noise contribution issues with abnormal wire nets.</p> <p>Default value: <code>nil</code></p>

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Plotting and Printing Commands

Value Returned

<code>t</code>	Returns <code>t</code> if noise summary is successfully printed to the file or port.
<code>nil</code>	Returns <code>nil</code> and an error message is shown if the summary cannot be printed.

Example

```
noiseSummary( 'integrated ?result 'noiseSweep-noise )
```

Prints a report for an integrated noise analysis.

```
noiseSummary( 'integrated ?resultsDir  
    "/usr/simulation/lowpass/spectre/schematic"  
    ?result 'noise)
```

Prints a report for an integrated noise analysis for the results from a different run (stored in the schematic directory).

```
noiseSummary( 'spot ?resultsDir  
    "/usr/simulation/lowpass/spectre/schematic"  
    ?result 'noise ?frequency 100M )
```

Prints a report for a spot noise analysis at a frequency of 100M.

```
noiseSummary('integrated ?truncateType 'none ?digits 10  
?weightFile "./weights.dat")
```

Prints the weighted noise for an integrated noise analysis using information in the weight file `weights.dat`.

```
noiseSummary('integrated ?output "./NoiseSum1" ?noiseUnit "V" ?truncateData 20  
?truncateType 'top ?from 10 ?to 10M ?deviceType list("bjt" "mos" "resistor"))
```

Prints a report for an integrated noise analysis in the frequency range 10–10M for 20 components with deviceType `bjt`, `mos` or `resistor`.

```
noiseSummary( 'integrated ?from 1 ?to 100M ?truncateType 'top ?truncateData 20  
?deviceType 'all ?noiseUnit "V^2" ?output "./filename.ns" ?paramValues list(2.47e-  
9))
```

Prints a report for an integrated noise analysis at a specific swept value.

ocnGenNoiseSummary

```
ocnGenNoiseSummary(  
    x_hierLevel  
    s_resultName  
    t_resultsDir  
)  
=> t / nil
```

Description

Generates a noise summary report at the end of a simulation run. This report contains a summary of noise contribution of each component for the specified hierarchy level.

Arguments

x_hierLevel

Specifies the level of hierarchy upto which the current data is to be saved for all the components.

s_resultName

Results from an analysis.

When specified, this argument will only be used internally and will not alter the current result which was set by the selectResult command. The default is the current result selected with the `selectResult` command.

t_resultsDir

Directory containing the PSF files (results).

When specified, this argument will only be used internally and will not alter the current results directory that is set by the openResults command. The default is the current results directory set by the `openResults` command.

Note: If you specify this argument, you must also specify the *s_resultName* argument.

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Value Returned

<code>t</code>	Creates a noise summary file within the results directory.
<code>nil</code>	Returns <code>nil</code> otherwise.

Example

```
ocnGenNoiseSummary(1 ?result 'pnoise)
=> t
```

Generates a noise summary report for all the components up to the first level of the hierarchy.

ocnPrint

```
ocnPrint(  
    [ ?output t_filename | p_port ]  
    [ ?precision x_precision ]  
    [ ?numberNotation s_numberNotation ]  
    [ ?numSpaces x_numSpaces ]  
    [ ?width x_width ]  
    [ ?from x_from ]  
    [ ?to x_to ]  
    [ ?step x_step ]  
    [ ?linLog t_linLog ]  
    o_waveform1 [ o_waveform2 ... ]  
)  
=> t / nil
```

Description

Prints the text data of the waveforms specified in the list of waveforms.

If you provide a filename as the `?output` argument, the `ocnPrint` command opens the file and writes the information to it. If you provide a port (the return value of the SKILL `outfile` command), the `ocnPrint` command appends the information to the file that is represented by the port. There is a limitation of *ocnPrint* for precision. It works upto 30 digits for the Solaris port and 18 digits for HP and AIX.

Note: `ocnPrint()` prints z-state as “HiZ” for digital signals.

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Plotting and Printing Commands

Arguments

<code>?output t_filename</code>	File in which to write the information. The <code>ocnPrint</code> command opens the file, writes to the file, and closes the file. If you specify the filename without a path, the OCEAN environment creates the file in the directory pointed to by your SKILL Path. To find out what your SKILL path is, type <code>getSkillPath()</code> at the OCEAN prompt.
<code>?output p_port</code>	Port (previously opened with <code>outfile</code>) through which to append the information to a file. You are responsible for closing the port. See the <code>outfile</code> command for more information.
<code>?precision x_precision</code>	<p>The number of significant digits to print. This value overrides any global precision value set with the <code>setup</code> command.</p> <p>Valid values: 1 through 16</p> <p>Default value: 6</p> <p>Note: To print the specified significant number of digits, ensure that the value of the <code>x_width</code> argument is the same or greater than the value of the <code>x_precision</code> argument.</p>
<code>?numberNotation s_numberNotation</code>	<p>The notation for printed information. This value overrides any global format value set with the <code>setup</code> command.</p> <p>Valid values: 'suffix', 'engineering', 'scientific', 'none'</p> <p>Default value: 'suffix'</p> <p>The format for each value is 'suffix: 1m, 1u, 1n, etc.; 'engineering: 1e-3, 1e-6, 1e-9, etc.; 'scientific: 1.0e-2, 1.768e-5, etc.; 'none.</p> <p>The value 'none is provided so that you can turn off formatting and therefore greatly speed up printing for large data files. For the fastest printing, use the 'none value and set the <code>?output</code> argument to a filename or a port, so that output does not go to the CIW.</p>

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Plotting and Printing Commands

<code>?numSpace x_numSpaces</code>	The number of spaces between columns. Valid values: 1 or greater Default value: 4
<code>?width x_width</code>	The width of each column. Valid values: 4 or greater Default value: 14
<code>?from x_from</code>	The start value at x axis for the waveform to be printed.
<code>?to x_to</code>	The end value at x axis for the waveform to be printed.
<code>?step x_step</code>	The step by which text data to be printed is incremented.
<code>?linLog t_linLog</code>	The scale to be used for printing. Valid values: Linear, Log Default value: Linear
<code>o_waveform1</code>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX.</code>)
<code>o_waveform2</code>	Additional waveform object.

Value Returned

<code>t</code>	Returns <code>t</code> if the text for the waveforms is printed.
<code>nil</code>	Returns <code>nil</code> and an error message if the text for the waveforms cannot be printed.

Example

```
ocnPrint( v( "/net56" ) )  
=> t
```

Prints the text for the waveform for the voltage of `net56`.

```
ocnPrint( vm( "/net56" ) vp( "/net56" ) )  
=> t
```

Prints the text for the waveforms for the magnitude of the voltage of `net56` and the phase of the voltage of `net56`.

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Plotting and Printing Commands

```
ocnPrint( ?output "myFile" v( "net55" ) )  
=> t
```

Prints the text for the specified waveform to a file named `myFile`.

```
ocnPrint( ?output "./myOutputFile" v("net1") ?from 0 ?to 0.5n ?step 0.1n )
```

Prints the text for the specified waveform from 0 to 0.5n on the x axis in the incremental steps of 0.1n.

ocnPrintTMIReliabilityResults

```
ocnPrintTMIReliabilityResults(  
    t_psfdir  
    [ ?resultType t_resultType ]  
    [ ?threshold t_threshold ]  
    [ ?exportFile t_exportFilePath ]  
    [ ?sortRule t_sortRule ]  
) t / nil
```

Description

Prints simulation results for reliability analysis run in the OCEAN mode.

Arguments

<i>t_psfdir</i>	Path to the PSF directory in which simulation results of reliability analysis for the test are saved.
<i>?resultType t_resultType</i>	Name of the result type for which you need to view results. Default value: <i>nil</i>
<i>?threshold t_threshold</i>	Threshold value. A result value greater than this threshold will be printed. Other values are ignored. Default value: <i>nil</i>
<i>?exportFile t_exportFilePath</i>	Path to the file where you need to export the printed results in CSV format. If you do not specify this path, the results are displayed on the terminal. Default value: <i>nil</i>
<i>?sortRule t_sortRule</i>	Rule to identify the column to be used for ranking of data. Default value: <i>nil</i>

Value Returned

<i>t</i>	When the results of reliability simulation are successfully printed.
<i>nil</i>	Returns <i>nil</i> otherwise.

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Plotting and Printing Commands

Examples

Example 1

The following example code prints the reliability results from the given psf directory on the terminal:

```
psfdir = "./simulation/bertlink/test/maestro/results/maestro/Interactive.0/3/
bertlink:osc13:1/psf"
=> "./simulation/bertlink/test/maestro/results/maestro/Interactive.0/3/
bertlink:osc13:1/psf"

ocnPrintTMIReliabilityResults(psfdir)
=> t
```

Example 2

The following example code checks the available result types in the reliability results and exports those to a file:

```
psfdir = "./simulation/bertlink/test/maestro/results/maestro/Interactive.0/3/
bertlink:osc13:1/psf"
=> "./simulation/bertlink/test/maestro/results/maestro/Interactive.0/3/
bertlink:osc13:1/psf"

ocnPrintTMIResultTypeList(psfdir)
=> ("DeltaTemp" "didlinBti" "didlinHci" "didlinHciBti" "didsatBti"
"didsatHci" "didsatHciBti" "dvtlinBti" "dvtlinHci" "dvtlinHciBti"
"lifetimeBti" "lifetimeHci" "lifetimeHciBti"
)
ocnPrintTMIReliabilityResults(psfdir ?resultType "DeltaTemp" ?threshold "3"
?exportFile "./TMIResults.csv")
; prints results on the terminal
=> t
```

Example 3

The following example code sorts the results on the basis of column didlinHciBti:

```
ocnPrintTMIReliabilityResults(psfdir ?sortRule "didlinHciBti" ?exportFile "./1")

Rank InstanceName Model DeltaTemp didsatHciBti didlinHciBti dvtlinHciBti
1 IL6.M1 pch_svt_mac.12 3.68E+01 8.90E+00 4.69E+00 3.34E-02
2 IL5.M1 pch_svt_mac.12 3.81E+01 8.11E+00 4.27E+00 3.04E-02
2 IL4.M1 pch_svt_mac.12 3.81E+01 8.11E+00 4.27E+00 3.04E-02
3 IL7.M1 pch_svt_mac.12 2.18E+01 8.04E+00 4.24E+00 3.02E-02
4 I1.M1 pch_svt_mac.12 1.25E+01 7.16E+00 3.77E+00 2.69E-02
5 IL1.M1 pch_svt_mac.12 3.67E+01 6.49E+00 3.42E+00 2.44E-02
5 IL3.M1 pch_svt_mac.12 3.67E+01 6.49E+00 3.42E+00 2.44E-02
5 IL2.M1 pch_svt_mac.12 3.67E+01 6.49E+00 3.42E+00 2.44E-02
6 I4.M1 pch_svt_mac.12 7.13E+00 6.32E+00 3.33E+00 2.37E-02
7 I9.M1 pch_svt_mac.12 5.45E+00 6.21E+00 3.27E+00 2.33E-02
=> t
;; note the ranking done in the results printed above.
```

ocnPrintTMIResultTypeList

```
ocnPrintTMIResultTypeList(  
    t_psfdir  
    [ ?netlistFilePreName t_prefixOfNetlistFile ]  
    ) t_resultTypes / nil
```

Description

Returns a list of valid result types.

Arguments

<i>t_psfdir</i>	Path to the PSF directory in which simulation results of reliability analysis for the test are saved.
<i>?netlistFilePreName</i> <i>t_prefixOfNetlistFile</i>	Prefix of the name of the netlist file. The function uses this prefix to search for the relevant mapping file saved by simulator. For example, if the specified prefix is "input", the netlist name is "input.scs", and the name of mapping file is ".input_tmi_deg.mapping". If the prefix is "amsControlSpectre", the netlist file is "amsControlSpectre.scs", and the name of mapping file is ".amsControlSpectre_tmi_deg.mapping". Default value: "input"

Value Returned

<i>l_resultTypes</i>	List of result types in the simulation results.
<i>nil</i>	Returns <i>nil</i> otherwise.

Example

The following example code checks the available result types in the reliability results and exports those to a file:

```
psfdir = "./simulation/bertlink/test/maestro/results/maestro/Interactive.0/3/  
bertlink:osc13:1/psf"  
=> "./simulation/bertlink/test/maestro/results/maestro/Interactive.0/3/  
bertlink:osc13:1/psf"
```


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```
ocnPrintTMIResultTypeList(psfdir)
=> ("DeltaTemp" "didlinBti" "didlinHci" "didlinHciBti" "didsatBti"
"didsatHci" "didsatHciBti" "dvtlinBti" "dvtlinHci" "dvtlinHciBti"
"lifetimeBti" "lifetimeHci" "lifetimeHciBti"
)
ocnPrintTMIReliabilityResults(psfdir ?resultType "DeltaTemp" ?threshold "3"
?exportFile "./TMIResults.csv")
=> t
```

ocnSetAttrib

```
ocnSetAttrib(  
    [ ?XAxisLabel xLabel ]  
    [ ?YAxisLabel yLabel ]  
    [ ?XScale xscale ]  
    [ ?YScale yscale ]  
    [ ?XLimit xlimit ]  
    [ ?YLimit ylimit ]  
    [ ?YRange yrange ]  
    [ ?Origin origin ]  
)  
=> t / nil
```

Description

Sets the waveform window plotting attributes.

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Arguments

<code>?XAxisLabel xLabel</code>	Label (symbol or string) for the X axis in the waveform window.
<code>?YAxisLabel yLabel</code>	Label (symbol or string) for the Y axis associated with the <i>stripNumber</i> in the waveform window.
<code>?XScale xScale</code>	Scale of the X axis in the waveform window. Valid values (symbols): 'auto, 'log, and 'linear
<code>?YScale yScale</code>	Scale of the Y axis associated with the <i>stripNumber</i> in the waveform window. Valid values (symbols): 'log and 'linear
<code>?XLimit xLimit</code>	Displays limits of the X axis in the waveform window. Valid values: List of two numbers or 'auto (symbol). The first number in the list indicates the minimum limit and the second indicates the maximum limit. 'auto sets the limit to autoscale.
<code>?YLimit yLimit</code>	Displays limits of the Y axis associated with the <i>stripNumber</i> in the waveform window. Valid values: List of two numbers or 'auto (symbol). The first number in the list indicates the minimum limit and the second indicates the maximum limit. 'auto sets the limit to autoscale.
<code>?YRange yRange</code>	Y range (integer) of the waveforms associated with the <i>stripNumber</i> in the waveform window.
<code>?Origin origin</code>	Axes origin of the waveform window. Valid values: List of two numbers.

Note: The valid range for *stripNumber* is 1-20.

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Value Returned

<code>t</code>	Returns <code>t</code> if the values of all arguments are set successfully.
<code>nil</code>	Returns <code>nil</code> if one or more arguments fail to set as specified.

Example

```
ocnSetAttrib( ?XAxisLabel 'XMyLabel ?YAxisLabel 'YMyLabelt ?stripNumber 2
              )
=> t
```

Sets the X and Y axis labels to *XMyLabel* and *YMyLabel*, respectively.

```
ocnSetAttrib(?XScale 'log ?YScale 'linear ?stripNumber 2 )
=> t
```

Sets the scale of X and Y axis to *log* and *linear*, respectively.

```
ocnSetAttrib(?XScale 'auto ?XLimit '(3 7) ?YLimit 'auto ?stripNumber 2 )
=> t
```

Sets the scale of X axis to autoscale. Sets the Y display limits to autoscale.

ocnWriteLsspToFile

```
ocnWriteLsspToFile(  
    filename t_filename  
    net1 input_node_name  
    term1 input_src_terminal  
    net2 output_node_name  
    term2 output_src_terminal  
    [ ?format t_format ]  
    [ ?datafmt t_data_format ]  
    [ ?port1 port1_name ]  
    [ ?port2 port2_name ]  
    [ ?result1 result1_name ]  
    [ ?result2 result2_name ]  
)  
=> nil
```

Description

Writes the large signal S-Parameter results to a file in Touchstone or Spectre format.

Arguments

<i>t_filename</i>	Name of the file in which results are to be written.
<i>input_node_name</i>	Name of the input node.
<i>input_src_terminal</i>	Name of the input source terminal.
<i>output_node_name</i>	Name of the output node.
<i>output_src_terminal</i>	Name of the output source terminal.
?format <i>t_format</i>	Format of file in which results are to be written. Possible values: touchstone, spectre Default value: 'touchstone
?data_fmt <i>t_data_format</i>	Format of data being written. Possible values: magphase, dbphase, realimag Default value: realimag
?port1 <i>port1_name</i>	Name of the first port. Default value: 50

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<code>?port2 <i>port2_name</i></code>	Name of the second port. Default value: 50
<code>?result1 <i>result1_name</i></code>	Name of the first pss result. Default value: <code>sweep1ssp1_lssp1_fd-sweep</code>
<code>?result2 <i>result2_name</i></code>	Name of the second pss result. Default value: <code>sweep1ssp2_lssp2_fd-sweep</code>

Value Returned

<code>t</code>	Specifies that the results are written to the specified file successfully.
<code>nil</code>	Returns <code>nil</code> if the results are not written.

Example

```
ocnWriteLsspToFile "lssp.sp2" "/net026" "/PORT1/PLUS" "/RFOUT"  
"/PORT2/PLUS" ?format "touchstone" ?datafmt "realimag" ?port1 50 ?port2 50  
?result1 "sweep1ssp1_lssp1_fd-sweep" ?result2 "sweep1ssp2_lssp2_fd-sweep")
```

ocnYvsYplot

```
ocnYvsYplot(  
  [ ?wavex o_wavex ?wavey o_wavey ]  
  [ ?exprx o_exprx ?expry o_expry ]  
  [ ?titleList l_titleList ]  
  [ ?colorList l_colorList ]  
)  
=> wave / nil
```

Description

Plots a wave against another wave or an expression against another expression.

This is currently supported for a family of waveforms generated from simple parametric simulation results data. It is not supported for a family of waveforms generated from parametric simulation with paramset, Corners or MonteCarlo results data.

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Arguments

<code>?wavex o_wavex</code>	Reference wave against which the wave provided needs to be plotted.
<code>?wavey o_wavey</code>	Wave to be plotted against the reference wave.
<code>?exprx o_exprx</code>	Reference expression against which the expression provided needs to be plotted.
<code>?expy o_expy</code>	Expression to be plotted against the reference expression.
<code>?titleList l_titleList</code>	List of waveform titles. If the waveform is simple, only one label will be required. If the waveform is param, a list of labels needs to be provided.
<code>?colorList l_colorList</code>	List specifying the colors for the waveforms. If you do not supply this argument, the default colors are used. The colors that are available are defined in your technology file. Valid Values: "y1" through "y66".

Value Returned

<code>wave</code>	Returns the waveform specified.
<code>nil</code>	Returns <code>nil</code> if the plot could not be generated.

Example

```
wy = VT("/vout")
wx = VT("/vin")
ex = "VT('/vin')"
ey = "VT('/vout')"
ocnYvsYplot(?wavex wx ?wavey wy ?titleList '("simpleWave") ?colorList '(y1))
```

Plots wave `wy` against wave `wx` with the title being `simpleWave` and the color being `y1`.

```
ocnYvsYplot(?exprx ex ?expy ey ?titleList '("simpleWave") ?colorList '(y2))
```

Plots expression `ey` against expression `ex` with the title being `simpleWave` and the color being `y2`.

plot

```
plot(  
    o_waveform1 [ o_waveform2 ... ]  
    [ ?expr l_exprList ]  
    [ ?strip x_stripNumber ]  
)  
=> t / nil
```

Description

Plots waveforms in the current subwindow. If there is no Virtuoso Visualization and Analysis XL window, this command opens one.

Note: `plot` is implemented as a macro and not as a SKILL function. Therefore, the functions that expect a function name as an argument will not accept `plot` as a valid argument. For example, the following call to the function `apply` is not valid:

```
apply('plot)
```

Arguments

<code>o_waveform1</code>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<code>o_waveform2</code>	Additional waveform object.
<code>?expr l_exprList</code>	List of strings used to give names to the waveform objects.
<code>?strip x_stripNumber</code>	An integer using which you can plot waveforms selectively on different strips and subwindows. If you specify an integer, it is used as the strip for all waveforms. To use the strip option for multiple waveforms, you can specify a list of strip numbers..

Value Returned

<code>t</code>	Returns <code>t</code> if the waveforms are plotted.
<code>nil</code>	Returns <code>nil</code> and an error message if the waveforms cannot be plotted.

Additional Information

Following are the scenarios that show how the `plot` and `displayMode` functions work together:

Case 1: When no waveform plot is open and you plot a waveform, `w1`, and then plot another waveform, `w2`, both the waveforms are plotted in one strip. Now if you set the `displayMode('strip')` function, the waveforms are plotted in two different strips.

1. `plot(w1)`
2. `plot(w2)`
`w1` and `w2` are plotted in one strip.
3. `displayMode('strip')`
`w1` and `w2` are plotted in two strips.
4. `plot(w3)`
`w3` is plotted in a new strip. The `?strip` argument is not required in this case.

Case 2: When no waveform plot is open and you set `displayMode('strip')`:

1. `displayMode('strip')`
2. `plot(w1)`
3. `plot(w2)`
`w2` is plotted in a new strip. The explicit `?strip` argument is not required in this case.

Case 3: When no waveform plot is open:

1. `plot(w1)`
2. `plot(w2)`
`w1` and `w2` are plotted in one strip.
3. `plot(w3 ?strip 2)`

w3 is plotted in a new strip because the plot function contains the ?strip 2 argument.

4. `plot(w4)`

w4 is plotted in the same strip as in which w3 is plotted.

Case 4: When no waveform plot is open:

1. `plot(w1 ?strip 1)`

2. `plot(w2 ?strip 2)`

w2 is plotted in strip 2.

3. `plot(w3 ?strip 1)`

w3 is plotted in strip 1.

4. `plot(w4 ?strip 2)`

w4 is plotted in strip 2, which now becomes an active strip.

5. `displayMode('strip')`

This divides the traces contained in strip 2 into individual strips, because strip 2 is the active strip now. Now, if you plot new waveforms in this strip, they are plotted in new strips. However, strip 1 continues to have two signals, w1 and w3.

6. `plot(w5)`

w5 is plotted in a new strip.

7. `plot(w6)`

w6 is plotted in a new strip.

Case 5: When no waveform plot is open:

1. `window=awvCreatePlotWindow()`

2. `awvSetDisplayMode(window "strip")`

3. `plot(w1)`

4. `plot(w2)`

5. `plot(w3)`

6. `plot(w4)`

w1, w2, w3, and w4 are plotted in four different strips.

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Case 6: Plot digital and analog data and set `displayMode(`composite)`. This combines all analog signals into a single strip. Now, if you set the `displayMode(`strip)`, the analog signals are divided into individual strips. These operations are applicable only on the active strip.

Example

```
plot(v( "/net56" ) )
```

Plots the waveform for the voltage of `net56`.

```
plot( vm( "/net56" ) vp( "/net56" ) )
```

Plots the waveforms for the magnitude of the voltage of `net56` and the phase of the voltage of `net56`.

```
plot( v( "OUT" ) i( "VFB" ) ?expr list( "voltage" "current" ) )
```

Plots the waveforms, but changes one legend label from `v("OUT")` to `voltage` and changes the other legend label from `i("VFB")` to `current`.

```
plot( v( "OUT" ) i( "VFB" ) )
```

Plots the waveforms `v("OUT")` and `i("VFB")` on the Y axes 1 and 2, respectively.

```
plot(wave1 wave2 wave3 ?strip list(1 2 2))
```

Plots `wave1` to strip 1, and `wave2` and `wave3` to strip 2.

plotStyle

```
plotStyle(  
    s_style  
)  
=> t / nil
```

Description

Sets the plotting style for all the waveforms in the current subwindow.

If the plotting style is `bar` and the display mode is `smith`, the plotting style is ignored until the display mode is set to `strip` or `composite`.

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Arguments

s_style Plotting style for the subwindow. Valid values: `auto`, `scatterplot`, `bar`, `joined`

Argument	Description
<code>auto</code>	The appropriate plotting style is automatically chosen.
<code>scatterplot</code>	Data points are not joined.
<code>bar</code>	Vertical bars are drawn at each data point that extend from the point to the bottom of the graph.
<code>joined</code>	Each data point is joined to adjacent data points by straight-line segments.

Value Returned

`t` Returns `t` if the plotting style is set.

`nil` Returns `nil` and an error message if the plotting style is not set.

Example

```
plotStyle( 'auto' )  
=> t
```

Sets the plot style to `auto`.

printGraph

```
printGraph(  
    [ ?window x_window ]  
    [ ?printerName s_hcPrinterName ]  
    [ ?horizontalMargin x_horizontalMargin ]  
    [ ?verticalMargin x_verticalMargin ]  
    [ ?numCopy x_numCopy ]  
    [ ?paperSize x_paperSize ]  
    [ ?orientation s_orientation ]  
    [ ?fileName s_fileName ]  
    [ ?tempDir s_tempDir ]  
    [ ?matchWindow g_matchWindow ]  
    [ ?numGraphsPerPage x_numGraphsPerPage ]  
    [ ?printMarkerTable g_printMarkerTable ]  
    [ ?markerTableLocation s_markerTableLocation ]  
    [ ?enableHeader g_enableHeader ]  
    [ ?enableFooter g_enableFooter ]  
    [ ?headerLeftText s_headerLeftText ]  
    [ ?headerCenterText s_headerCenterText ]  
    [ ?headerRightText s_headerRightText ]  
    [ ?footerLeftText s_footerLeftText ]  
    [ ?footerCenterText s_footerCenterText ]  
    [ ?footerRightText s_footerRightText ]  
    [ ?printColor g_printColor ]  
    [ ?doubleSidedPrint g_doubleSidedPrint ]  
    [ ?duplexMode s_duplexMode ]  
    [ ?pageOrder s_pageOrder ]  
)  
=> t / nil
```

Description

Prints the graph plotted in the specified window.

Arguments

?window *X_window* Window ID of the waveform window whose plot is to be sent to a printer or a file. The default value is the window ID of the current window.

?printerName *s_printerName*
Name of the printer to be used for printing.
Valid values: a string or nil
Default value: nil

?horizontalMargin *x_horizontalMargin*
Horizontal margin.
Valid values: any positive integer

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Default value: 18

`?verticalMargin x_verticalMargin`

Vertical margin

Valid values: any positive integer

Default value: 18

`?numCopy x_numCopy` Number of copies to be printed.

Valid values: any positive integer

Default value: 1

`?paperSize x_paperSize`

Size of paper used for printing.

Valid values: letter, legal, executive, folio, ledger, tabloid, a0, a1, a2, a3, a4, a5, a6, a7, a8, a9, b0, b1, b2, b3, b4, b5, b6, b7, b8, b9, b10, c5e, comm10e, and dle.

Default value: letter

`?orientation s_orientation`

Paper orientation. This option works only when you print a graph window and does not work when you save the window to a graph file.

Valid values: potrait, landscape, and automatic

Default value: landscape

`?fileName s_fileName`

Name of the output file. The output file can be created in one of the following file formats:

PS – PostScript (.ps)

PDF – Portable Document Format (.pdf)

Valid values: any string value or nil

Default value: nil

`?tempDir s_tempDir` Name of a temporary directory to be used for scratch space.

Valid values: name of a temporary directory

Default value: "/usr/tmp"

`?matchWindow g_matchWindow`

Specifies whether the print output is identical to the current graph window. This option is used if you want to print all the subwindows in a PDF file in the same order in which they are arranged in the graph.

Valid values: t or nil

Default value: nil

`?numGraphsPerPage x_numGraphsPerPage`

Specifies how many graphs are to be printed per page.

Valid values: Integer values 1, 2, 3, 4, 8, 12, 16, 20

Default value: 1

`?printMarkerTable g_printMarkerTable`

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Specifies whether the marker table is to be printed.

Valid values: `t` or `nil`.

Default value: `nil`.

`?MarkerTableLocation s_MarkerTableLocation`

Specifies the location of the marker table on the page to be printed.

Valid values: `belowGraph` and `separatePage`.

Default value: `belowGraph`.

`?enableHeader g_enableHeader`

Specifies whether the page contains a header.

Valid values: `t` or `nil`

Default value: `t`

`?enableFooter g_enableFooter`

Specifies whether the page contains a footer.

Valid values: `t` or `nil`

Default value: `t`

`?headerLeftText s_headerLeftText`

Sets the text to be printed to the left of header.

Valid values: any string value

Default value: `" "`

`?headerCenterText s_headerCenterText`

Sets the text to be printed in the center of the header.

Valid values: Any string value and the following macros—`$TOTALPAGES`, `$TITLE`, `$USERID`, `$PRINTER`, `$PAGE`, `$DATE`, `$DATETIME`, `$AUTHOR`, `$TIME`.

Default value: `$TITLE`

`?headerRightText s_headerRightText`

Sets the text to be printed to the right of the header.

Valid values: Any string value and the following macros—`$TOTALPAGES`, `$TITLE`, `$USERID`, `$PRINTER`, `$PAGE`, `$DATE`, `$DATETIME`, `$AUTHOR`, `$TIME`.

Default value: `$DATETIME`

`?footerLeftText s_footerLeftText`

Sets the text to be printed to the left of footer.

Valid values: Any string value and the following macros—`$TOTALPAGES`, `$TITLE`, `$USERID`, `$PRINTER`, `$PAGE`, `$DATE`, `$DATETIME`, `$AUTHOR`, `$TIME`.

Default value: Printed on `$PRINTER` by `$USERID`

`?footerCenterText s_footerCenterText`

Sets the text to be printed in the center of the footer.

Valid values: Any string value and the following macros—`$TOTALPAGES`, `$TITLE`, `$USERID`, `$PRINTER`, `$PAGE`, `$DATE`, `$DATETIME`, `$AUTHOR`, `$TIME`.

Default value: `" "`

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`?footerRightText s_footerRightText`

Sets the text to be printed on the right of the footer.

Valid values: Any string value and the following macros—\$TOTALPAGES, \$TITLE, \$USERID, \$PRINTER, \$PAGE, \$DATE, \$DATETIME, \$AUTHOR, \$TIME.

Default value: Page \$PAGE of \$TOTALPAGES

`?printColor g_printColor`

Specifies whether the print is to be colored

Valid values: `t` or `nil`

Default value: `t`

`?doubleSidedPrint g_doubleSidedPrint`

Specifies whether both the sides of paper is used for printing.

Valid values: `t` or `nil`

`?duplexMode s_duplexMode`

Specifies the duplex printing mode.

Valid values: `none`, `auto`, `shortSide`, `longSide`.

Default value: `auto`

`?pageOrder s_pageOrder`

Specifies the order in which pages are printed.

Valid values: `collate` and `reverse`

Default value: `collate`

Value Returned

<code>t</code>	Returns <code>t</code> if the function runs successfully.
----------------	---

<code>nil</code>	Returns <code>nil</code> if there is an error.
------------------	--

Examples

```
printGraph()
```

Prints the current graph window with the default printing options.

```
printGraph(?printerName "ind001" ?paperSize "a4" ?orientation
'portrait)
```

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Prints the current graph window by using the printer, `ind001`, with paper size `a4` and orientation `portrait`.

pzFrequencyAndRealFilter

```
pzFrequencyAndRealFilter(  
    o_wave  
    [ ?freqfilter f_fval ]  
    [ ?realfilter f_rval ] )  
=> o_waveform / nil
```

Description

Returns a filtered Pole or Zero waveform from the pole zero simulation data. Filtering is done on the basis of given maximum frequency and minimum real value.

Note: This command also works for the parametric or sweep data.

Arguments

<i>o_wave</i>	Input Pole or Zero waveform (complex points) from the simulation data of PZ analysis.
<i>?freqfilter f_val</i>	Maximum pole and zero frequency value to filter out poles and zeros that are outside the frequency band of interest (FBOI) and that do not influence the transfer function in the FBOI.
<i>?realfilter f_rval</i>	Minimum real value which is used to filter out poles and zeros whose real value are less than or equal to the value specified.

Values Returned

<i>o_waveform</i>	Returns a Pole or Zero waveform.
<i>nil</i>	Returns <i>nil</i> if there is an error.

Examples

```
pzFrequencyAndRealFilter(wave ?freqfilter 1e+24 ?realfilter 2e+10)  
=> srrWave:175051584
```

Returns a filtered Pole or Zero waveform, which is filtered on the basis of given maximum frequency and minimum real value.

pzPlot

```
pzPlot(  
  [ ?resultsDir t_resultsDir ]  
  [ ?result S_resultName ]  
  [ ?plot S_toPlot ]  
  [ ?freqfilter f_fval ]  
  [ ?realfilter f_rval ] )  
=> t / nil
```

Description

Plots a report showing the poles and zeros of the network. If you specify a directory with *resultsDir*, the *pzPlot* command plots the results for that directory. The *S_toPlot* option can be used to plot only poles, only zeros or both poles and zeros information.

This command should be run on the results of the Spectre pz (pole-zero) analysis.

Note: This command also works for the parametric or sweep data.

Arguments

t_resultsDir Directory containing the results. If you specify a directory with *resultsDir*, the *pzPlot* command plots the results for that directory.

S_resultName Pointer to results from the analysis for which you want to plot the report.

S_toPlot Use this option to plot only poles, only zeros or both poles and zeros information. Valid values: 'poles', 'zeros', 'polesZeros'.

f_fval Maximum pole and zero frequency value to filter out poles and zeros that are outside the frequency band of interest (FBOI) and that do not influence the transfer function in the FBOI.

f_rval Real value which is used to filter out poles and zeros whose real value are less than or equal to the value specified.

Value Returned

t Returns *t* if it plots a report.

nil Returns *nil* otherwise.

Example

```
pzPlot(?resultsDir "/usr/simulation/lowpass/spectre/schematic" ?result 'pz)
```

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Plots a report for all the poles and zeros for the specified results.

```
pzPlot(?resultsDir "/usr/simulation/lowpass/spectre/schematic" ?plot 'poles)
```

Plots a report containing only poles for the specified results.

```
pzPlot( ?plot 'zeros ?realfilter -1.69e-01)
```

Plots a report for all those zeros whose real values are greater than the real value specified.

```
pzPlot( ?plot 'polesZeros ?freqfilter 2.6e-01 )
```

Plots a report for all those poles and zeros whose frequency is within the frequency band of interest (2.6e-01).

pzSummary

```
pzSummary(  
    [ ?resultsDir t_resultsDir ]  
    [ ?result S_resultName ]  
    [ ?print S_toPrint ]  
    [ ?freqfilter f_fval ]  
    [ ?realfilter f_rval ]  
    [ ?output t_output]  
)  
=> t / nil
```

Description

Prints a report with the poles and zeros of the network. If you specify a directory with *resultsDir*, the *pzSummary* command prints the results for that directory. Use the *S_toPrint* option to print only poles, only zeros or both poles and zeros information.

This command should be run on the results of the Spectre pz (pole-zero) analysis.

Note: This command also works for the parametric or sweep data.

Arguments

t_resultsDir Directory containing the results. If you specify a directory with *resultsDir*, the *pzSummary* command plots the results for that directory.

S_resultName Pointer to results from the analysis for which you want to print the report.

S_toPlot Use this option to plot only poles, only zeros or both poles and zeros information. Valid values: 'poles', 'zeros', 'polesZeros'.

f_fval Maximum pole and zero frequency value to filter out poles and zeros that are outside the frequency band of interest (FBOI) and that do not influence the transfer function in the FBOI.

f_rval Real value which is used to filter out poles and zeros whose real value are less than or equal to the value specified.

t_output Provides an option to write the output to a file. The possible values can be a file name or a port name.

Value Returned

t Returns *t* if it prints a report.

nil Returns *nil* otherwise.

OCEAN Reference

Plotting and Printing Commands

Example

```
pzSummary(?resultsDir "/usr/simulation/lowpass/spectre/schematic" ?result 'pz)
```

Prints a report for all the poles and zeros for the specified results.

```
pzSummary(?resultsDir "/usr/simulation/lowpass/spectre/schematic" ?print 'poles)
```

Prints a report containing only poles for the specified results.

```
pzSummary( ?print 'zeros ?realfilter -1.69e-01)
```

Prints a report for all those zeros whose real values are less than or equal to the real value specified.

```
pzSummary( ?print 'polesZeros ?freqfilter 2.6e-01 )
```

Prints a report for all those poles and zeros whose frequency is within the frequency band of interest (2.6e-01).

```
pzSummary( ?output "/tmp/file")
```

Prints results in the file.

```
pzSummary( ?output "file")
```

Prints results in a file located in the current working directory.

```
pzSummary( ?output oFile)
where, oFile=outfile("/tmp/file")
```

Prints to the opened file

```
pzSummary( ?output nil)
pzSummary( ?output t)
pzSummary( ?output 32)
```

Prints results on the CIW or Ocean command-line.

removeLabel

```
removeLabel(  
    l_id  
)  
=> t / nil
```

Description

Removes the label, or all the labels identified in a list, from the current subwindow.

Arguments

<i>l_id</i>	List of labels to remove.
-------------	---------------------------

Value Returned

<i>t</i>	Returns <i>t</i> when the label or labels are removed.
<i>nil</i>	Returns <i>nil</i> if there is an error.

Example

```
label = addWindowLabel( list( 0.75 0.75 ) "test" )
```

Adds the "test" label to the current subwindow at the specified coordinates and stores the label identification number in *label*.

```
removeLabel( label )
```

Removes the label whose identification number is stored in *label*. In this case, the "test" label is removed.

report

```
report(  
  [ ?output t_filename | p_port ]  
  [ ?type t_type ]  
  [ ?name t_name ]  
  [ ?param t_param ]  
  [ ?format s_reportStyle ]  
  [ ?report s_reportStyle ]  
  [ ?maxLineWidth charsPerLine ]  
)  
=> t / nil
```

Description

Prints a report of the information contained in an analysis previously specified with `selectResult`.

You can use this command to print operating-point, model, or component information. If you provide a filename as the `?output` argument, the `report` command opens the file and writes the information to it. If you provide a port (the return value of the `SKILL outfile` command), the `report` command appends the information to the file that is represented by the port.

Note: You can use the `dataTypes` command to see what types of reports you can choose. For Spectre® circuit simulator operating points, be sure to choose `dcOpInfo`.

Arguments

t_filename File in which to write the information. The `report` command opens the file, writes to the file, and closes the file. If you specify the filename without a path, the OCEAN environment creates the file in the directory pointed to by your SKILL Path. To find out what your SKILL path is, type `getSkillPath()` at the OCEAN prompt.

p_port Port (previously opened with `outfile`) through which to append the information to a file. You are responsible for closing the port. See the [outfile](#) command for more information.

t_type Type of information to print, such as all bjts.

t_name Name of the node or component.

t_param Name of the parameter to print. It is also a list.

s_reportStyle Specifies the format of the output.

Valid values: `spice` and `paramValPair`

Default value: `paramValPair`

OCEAN Reference

Plotting and Printing Commands

The `spice` format looks like this:

	Param1	Param2	Param3
Name1	value	value	value
Name2	value	value	value
Name3	value	value	value

The `paramValPair` format looks like this:

Name1
Param1=value Param2=value Param3=value

Name2
Param1=value Param2=value Param3=value

Name3
Param1=value Param2=value Param3=value

charsPerLine Number of characters to be printed per line.

Value Returned

`t` Returns `t` if the information is printed.

`nil` Returns `nil` and an error message if the information cannot be printed.

Example

The following example shows how to display a report by using the results of an analysis already run. First, run the `results()` command to get a list of the type of results that exist in the current results directory.

```
results()  
=> ( dcOpInfo tran ac dc)
```

From the list of result types returned by the previous function, select a particular type of results for which you want to print the report.

```
selectResult( 'dcOpInfo' )  
=> t
```

Use the `report` function to print the results. The following examples show how to print different details in a report:

```
report()  
=> t
```

OCEAN Reference

Plotting and Printing Commands

Prints all the operating-point parameters.

```
report( ?type "bjt" )  
=> t
```

Prints all the `bjt` operating-point parameters.

```
report( ?type "bjt" ?param "ib" )  
=> t
```

Prints the `ib` parameter for all bjts.

```
report( ?type "bjt" ?name "/Q1" ?param "ib" )  
=> t
```

Prints the `ib` parameter for the `bjt` named `Q1`.

```
report( ?output "myFile" )  
=> t
```

Prints all the operating-point parameters to a file named `myFile`.

```
report( ?output myAlreadyOpenedPort )  
=> t
```

Prints all the operating-point parameters to a port named `myAlreadyOpenedPort`.

The `report()` can also be used by providing the set of parameters as a list as follows:

```
Type : bsim3v3  
Params : cdg cgb gm ids  
report( ?type "bsim3v3" ?param "cdg" )  
report( ?type "bsim3v3" ?param '( "cdg" "cgb" ) )  
report( ?type "bsim3v3" ?param '( "cdg" "cgb" "gm" "ids" ) )  
  
report( ?format 'spice ?maxLineWidth 200 )  
=> t
```

Prints the report in spice format wrapping at column 200.

saveGraphImage

```
saveGraphImage (
  [ ?window x_window ]
  [ ?fileName x_fileName ]
  [ ?exactCopy g_exactCopy ]
  [ ?quality x_quality ]
  [ ?msOptimize g_msOptimize ]
  [ ?width x_width ]
  [ ?height x_height ]
  [ ?units s_units ]
  [ ?resolution x_resolution ]
  [ ?resolutionUnits s_resolutionUnits ]
  [ ?aspectRatio g_aspectRatio ]
  [ ?enableTitle g_enableTitle ]
  [ ?enableLegend g_enableLegend ]
  [ ?enableAxes g_enableAxes ]
  [ ?enableGrids g_enableGrids ]
  [ ?backgroundColor s_backgroundColor ]
  [ ?saveAllSubwindows g_saveAllSubwindows ]
  [ ?saveEachSubwindowSeparately g_saveEachSubwindowSeparately ]
)
=> x_fileName / nil
```

Description

Saves the graph as an image.

OCEAN Reference

Plotting and Printing Commands

Arguments

`?window x_window`

Window ID of the waveform window whose plot is to be saved in a file. The default value is the window ID of the current window.

`?fileName x_fileName`

Name of the output file to be created. The output file can be created in one of the following file formats:

- BMP – Windows Device Independent Bitmap (.bmp)
 - PNG – Portable Network Graphics (.png)
 - TIFF – Tagged Image File Format (.tiff)
 - EPS – Encapsulated Post Script (.eps)
 - PDF – Portable Document Format (.pdf)
 - PPM – Portable PixMap File (.ppm)
 - JPG – Joint Photographic Experts Group (.jpg)
 - SVG – Scalable Vector Graphics (.svg)
 - XPM – X PixMap (.xpm)
- Valid values: any string value or `nil`

Default value: `nil`.

Note: If `fileName` argument is not specified, the graph image is saved in a `image.png` file.

`?exactCopy g_exactCopy`

Saves the exact copy of all subwindows. Only `?quality` and `?fileName` arguments work with this option. This option does not work for the `eps` file format.

Valid values: `t` or `nil`

Default value: `nil`

`?quality x_quality`

Modifies the quality of the image. This option works only for the `.jpeg` file format. This option does not work for the `eps` file format.

Valid values: 20 to 100%

Default value: 85%

OCEAN Reference

Plotting and Printing Commands

<code>?msOptimize</code>	<code>g_msOptimize</code>	Enables the image to be imported in the Microsoft office application. This option is available when you select the image type as Encapsulated PostScript (*.eps). This option simplifies the image output so that it can be ready by Microsoft Office 2003 and 2007 applications
		Valid values: <code>t</code> or <code>nil</code>
		Default value: <code>t</code>
<code>?width</code>	<code>x_width</code>	Sets the width of the image.
		Valid values: Any positive integer value.
		Default value: 800 pixels for <code>bmp</code> , <code>png</code> , <code>tiff</code> , <code>ppm</code> and <code>xpm</code> file formats and 8.33 inches for <code>pdf</code> , <code>svg</code> and <code>eps</code> file formats.
<code>?height</code>	<code>x_height</code>	Sets the height of the image
		Valid values: Any positive integer value.
		Default value: 600 pixels for <code>bmp</code> , <code>png</code> , <code>tiff</code> , <code>ppm</code> and <code>xpm</code> file formats and 6.25 inches for <code>pdf</code> , <code>svg</code> and <code>eps</code> file formats.
<code>?units</code>	<code>s_units</code>	Specifies the unit for image size (height and width)
		Valid values: <code>inch</code> , <code>cm</code> , <code>mm</code> , <code>picas</code> , <code>pixels</code> , and <code>points</code>
		Default value: <code>pixels</code> for <code>bmp</code> , <code>png</code> , <code>tiff</code> , <code>ppm</code> file formats and <code>xpm</code> and <code>inch</code> for <code>pdf</code> , <code>svg</code> and <code>eps</code> file formats.
<code>?resolution</code>	<code>x_resolution</code>	Sets the image resolution. This option works only for the <code>bmp</code> , <code>jpeg</code> , <code>png</code> , <code>ppm</code> , <code>tiff</code> , and <code>xpm</code> file formats. It does not work for <code>eps</code> , <code>pdf</code> , and <code>svg</code> file formats.
		Valid values: Any positive integer value.
		Default value: 96
<code>?resolutionUnits</code>	<code>s_resolutionUnits</code>	

OCEAN Reference

Plotting and Printing Commands

Sets the units for image resolution. This option works only for the `bmp`, `jpeg`, `png`, `ppm`, `tif`, and `xpm` file formats. It does not work for `eps`, `pdf`, and `svg` file formats.

Valid values: `pixels/cm` and `pixels/in`

Default value: `pixels/in`

`?aspectRatio g_aspectRatio`

Enables the aspect ratio, which is the ratio of the width of the image to its height.

Valid values: `t` or `nil`

Default value: `nil`

`?enableTitle g_enableTitle`

Displays the trace title in the graph image.

Valid values: `t` or `nil`

Default value: `t`

`?enableLegend g_enableLegend`

Displays the trace legend in the graph image.

Valid values: `t` or `nil`

Default value: `t`

`?enableAxes g_enableAxes`

Displays the axes in the graph image.

Valid values: `t` or `nil`

Default value: `t`

`?enableGrids g_enableGrids`

Displays the grids in the graph image.

Valid values: `t` or `nil`

Default value: `t`

Note: You cannot set this argument to `t` if `?enableAxes` is set to `nil`. If you want to display the grids in the graph image, ensure that `?enableAxes` is set to `t`.

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Plotting and Printing Commands

`?backgroundColor` *g_backgroundColor*

Specify the background color.

Default value: `nil`, which means graph image is saved with the current background color

Valid values: All the valid color values are defined at the following location: <http://www.w3.org/TR/SVG/types.html#ColorKeywords>

For example, red, blue, green, black, white, gray, cyan, magenta, yellow, and so on.

`?saveAllSubwindows` *g_saveAllSubwindows*

Saves all subwindows or the current subwindow.

Default value: `t`

Valid values:

- `t`: All subwindows are saved.
- `nil`: Only the current subwindow is saved.

`?saveEachSubwindowSeparately` *g_saveEachSubwindowSeparately*

Specifies whether to save each subwindow in a separate image file or in the same image file.

Valid values: `t` or `nil`

Default value: `t`

Value Returned

x_fileName

Returns the name of the output file.

`nil`

Returns `nil` if there is an error.

Examples

■ `saveGraphImage()`

Saves the current graph window with the default saving options.

■ `saveGraphImage(?fileName "ViVA.jpg" ?enableTitle t ?enableLegend nil)`

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Plotting and Printing Commands

Saves the current graph window in the `ViVA.jpg` file with only trace legend enabled.

- `saveGraphImage(?window currentWindow() ?fileName "ViVA.jpg"`
`?backgroundColor "light gray")`

Saves the current graph window in the `ViVA.jpg` file with background color as light gray.

Additional Information

Following are the guidelines supported by the `saveGraphImage` function:

- Arguments *exactCopy*, *quality*, *resolution*, and *resolutionUnits* are ignored for `eps` file format.
- Only *fileName* and *quality* arguments can be used with *exactCopy* argument. All other arguments are ignored.
- Argument *quality* can be used only with `jpeg` file format. It is ignored for other formats.
- Arguments *resolution* and *resolutionUnits* cannot be set for `eps`, `pdf`, and `svg` file formats.
- Argument *msOptimize* can be set to `nil` only for `eps` file format.
- Argument *enableGrids* cannot be set to `true` when *enableAxes* is `nil`.

xLimit

```
xLimit(  
    l_minMax  
)  
=> t / nil
```

Description

Sets the X axis display limits for the current subwindow. This command does not take effect if the display mode is set to `smith`.

Arguments

<code>l_minMax</code>	List of two numbers in waveform coordinates that describe the limits for the display. The first number is the minimum and the second is the maximum. If this argument is set to <code>nil</code> , the limit is set to <code>auto</code> .
-----------------------	--

Value Returned

<code>t</code>	Returns <code>t</code> when the X axis display limits are set.
<code>nil</code>	Returns <code>nil</code> and an error message if the X axis display limits are not set.

Example

```
xLimit( list( 1 100 ) )  
=> t
```

Sets the X axis to display between 1 and 100.

yLimit

```
yLimit(  
    l_minMax  
    [ ?stripNumber x_stripNumber ]  
)  
=> t / nil
```

Description

Sets the Y axis display limits for the waveforms associated with a particular Y axis and strip in the current subwindow.

If you do not specify *x_stripNumber*, the limits are applied when the subwindow is in *composite mode*.

Arguments

<i>l_minMax</i>	List of two numbers in waveform coordinates that describe the limits for the display. The first number is the minimum and the second is the maximum. If this argument is set to <i>nil</i> , the limit is set to <i>auto</i> .
<i>?stripNumber</i> <i>x_stripNumber</i>	Specifies the strip in which the y display is to be limited in the range specified by <i>l_minMax</i> . Valid values: 1 through 20

Value Returned

<i>t</i>	Returns <i>t</i> if the Y axis display limits are set.
<i>nil</i>	Returns <i>nil</i> and an error message if the Y axis display limits cannot be set.

Example

```
yLimit( list( 4.5 7.5 ) )  
=> t
```

Sets Y axis 1 to display from 4.5 to 7.5.

PI¹

You can access SpectreRF functions in OCEAN by using the `getData` function and then plot or print them in OCEAN using the `ocnPrint` and `plot` functions.

To take an example, after performing a spectre sp analysis in the Analog Design Environment, click *Results – Direct Plot – Main Form*. In the S-Parameter Results form, select the function and other options that you want to plot. Also, select the *Add to Outputs* option under the *Plot* button. Then, click *OK*. The expression will be added to the *Outputs* pane of the ADE window. When all the desired expressions are created in the *Outputs* pane, use the *ADE – Session – Save Ocean Script* command to create the OCEAN script for these plots.

To plot the expression in OCEAN, use the following command:

```
plot(<expression in Output pane>)
```

For example,

```
plot(Gmax())      for Gmax in S-parameter analysis
```

You can print the functions using the `ocnPrint` command. For example:

```
ocnPrint( Gmax() Kf() )
```

After a spectre sp noise analysis, use the following command to access the sp noise data.

```
selectResult("sp_noise")
```

A sample OCEAN script to help you print or plot NFmin (minimum noise figure), N F (noise figure), and RN (noise resistance) results follows. Plotting NNR (normalized noise resistance) is similar to plotting RN.

```
; start ocean with Spectre as the as the simulator.
simulator( 'spectre' )
;specify design and model path
design( "/usr1/mnt4/myhome/simulation/myckt/schematic/netlist/myckt.c")
path( "/usr1/mnt4/myhome/models" )
; specify analysis used:  sp with noise
analysis('sp ?start "100M"  ?stop "10G"  ?donoise "yes"
?oprobe "/PORT1"  ?iprobe "/PORT0"  )
;set design variables
desVar(  "r2" 37)
desVar(  "r1" 150)
;set temperature
temp( 25 )
```

1.

OCEAN Reference

Plotting and Printing Commands

```
;run sp noise analysis with the above desVar list.
run()
printf("\n simulation has finished.")
printf("\n selecting sp noise results")
selectResult("sp_noise")
printf("\n print NFmin and plot NF")
NFmin = getData("NFmin")
NF = getData("NF")
ocnPrint( NFmin )
plot( NF )
printf("\n plot Rn")
Rn = getData("RN" ?result "sp_noise")
plot( Rn ?expr '( "Rn" ) )
exit
```

For more information, see the section *Periodic Noise Analysis* and the appendix *Plotting Spectre S-Parameter Simulation Data* in the *Virtuoso Spectre Circuit Simulator RF Analysis User Guide*.

For more information on these functions, click these links: [getData](#), [sp](#), [ocnPrint](#), and [plot](#).

OCEAN Aliases

The aliases in this chapter provide you with shortcuts to commonly used pairs of commands. By default, these aliases operate on results previously selected with `selectResult`. However, you can also use an alias on a different set of results. For example, to specify a different set of results for the `vm` alias, use the following syntax.

```
vm( t_net [?result s_resultName] )
```

where `s_resultName` is the name of the datatype for the particular analysis you want.

You can use the `vm` alias on results stored in a different directory as follows:

```
vm( t_net [?resultsDir t_resultsDir] [?result s_resultName] )
```

where `t_resultsDir` is the name of a different directory containing PSF results, and `s_resultName` is the name of a datatype contained in that directory. (If you specify another directory with `t_resultsDir`, you must also specify the particular results with `s_resultName`.)

List of Aliases

Alias	Syntax	Description
vm	<code>vm(t_net [?resultsDir t_resultsDir] [?result s_resultname]) => o_waveform/ nil</code>	Aliased to <code>mag(v())</code> . Gets the magnitude of the voltage of a net.
vdb	<code>vdb(t_net [?resultsDir t_resultsDir] [?result s_resultname]) => o_waveform/ nil</code>	Aliased to <code>db20(v())</code> . Gets the power gain in decibels from net in to net out.
vp	<code>vp(t_net [?resultsDir t_resultsDir] [?result s_resultname]) => o_waveform/ nil</code>	Aliased to <code>phase(v())</code> . Gets the phase of the voltage of a net.

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OCEAN Aliases

List of Aliases, *continued*

vr	<pre>vr(t_net [?resultsDir t_resultsDir] [?result s_resultName]) => o_waveform/nil</pre>	Aliased to <code>real(v())</code> . Gets the real part of a complex number representing the voltage of a net.
vim	<pre>vim(t_net [?resultsDir t_resultsDir] [?result s_resultName]) => o_waveform/nil</pre>	Aliased to <code>imag(v())</code> . Gets the imaginary part of a complex number representing the voltage of a net.
im	<pre>im(t_component [?resultsDir t_resultsDir] [?result s_resultName]) => o_waveform/nil</pre>	Aliased to <code>mag(i())</code> . Gets the magnitude of the AC current through a component.
ip	<pre>ip(t_component [?resultsDir t_resultsDir] [?result s_resultName]) => o_waveform/nil</pre>	Aliased to <code>phase(i())</code> . Gets the phase of the AC current through a component.
ir	<pre>ir(t_component [?resultsDir t_resultsDir] [?result s_resultName]) => o_waveform/nil</pre>	Aliased to <code>real(i())</code> . Gets the real part of a complex number representing the AC current through a component.
iim	<pre>iim(t_component [?resultsDir t_resultsDir] [?result s_resultName]) => o_waveform/nil</pre>	Aliased to <code>imag(i())</code> . Gets the imaginary part of a complex number representing the AC current through a component.

Predefined and Waveform (Calculator) Functions

This chapter contains information about the following functions.

■ Predefined Arithmetic Functions

abs

acos

add1

asin

atan

cos

exp

int

linRg

log

logRg

max

min

mod

random

round

sin

sqrt

OCEAN Reference

Predefined and Waveform (Calculator) Functions

srandom

sub1

tan

xor

■ Waveform (Calculator) Functions

average

abs_jitter

analog2Digital

awvCreateBus

awvPlaceXMarker

awvPlaceYMarker

awvRefreshOutputPlotWindows

b1f

bandwidth

clip

clipX

closeResults

compare

compression

compressionVRI

compressionVRICurves

complex

complexp

conjugate

convolve

cPwrContour

cReflContour

OCEAN Reference

Predefined and Waveform (Calculator) Functions

cross

db10

db20

dbm

delay

delayMeasure

deriv

dft

dftbb

dnl

dutyCycle

evmQAM

evmQpsk

eyeDiagram

eyeAperture

eyeMeasurement

edgeTriggeredEyeDiagram

flip

fourEval

freq

freq_jitter

frequency

ga

gac

gainBwProd

gainMargin

gmax

OCEAN Reference

Predefined and Waveform (Calculator) Functions

gmin

gmsg

gmux

gp

gpc

groupDelay

gt

harmonic

harmonicFreqList

harmonicList

histo

histogram2D

iinteg

imag

inl

integ

intersect

ipn

ipnVRI

ipnVRICurves

kf

ln

log10

lsb

lshift

mag

nc

OCEAN Reference

Predefined and Waveform (Calculator) Functions

normalQQ

overshoot

pavg

peak

peakToPeak

period_jitter

phase

phaseDeg

phaseDegUnwrapped

phaseDegUnwrappedWithFreq

phaseMargin

phaseRad

phaseRadUnwrapped

PN

pow

prms

psd

psdbb

pstddev

pzbode

pzfilter

rapidIPNCurves

rapidIIPN

real

riseTime

rms

rmsNoise

OCEAN Reference

Predefined and Waveform (Calculator) Functions

rmsVoltage

rmsTerminalVoltage

root

rshift

sample

settlingTime

slewRate

smithType

spectralPower

spectrumMeasurement

ssb

stddev

tangent

thd

thd_fd

unityGainFreq

value

xmax

xmin

xval

ymax

ymin

RF Functions in Spectre

Predefined Arithmetic Functions

Several functions are predefined in the Virtuoso® SKILL language. The full syntax and brief definitions for these functions follows the table.

Predefined Arithmetic Functions

Synopsis	Result
General Functions	
<code>add1(n)</code>	$n + 1$
<code>abs</code>	$ n $
<code>sub1(n)</code>	$n - 1$
<code>exp(n)</code>	e raised to the power n
<code>linRg(<i>n_from</i>, <i>n_to</i>, <i>n_by</i>)</code>	Returns list of numbers in linear range from <i>n_from</i> to <i>n_to</i> in <i>n_by</i> steps
<code>log(n)</code>	Natural logarithm of n
<code>logRg(<i>n_from</i>, <i>n_to</i>, <i>n_by</i>)</code>	Returns list of numbers in log10 range from <i>n_from</i> to <i>n_to</i> in <i>n_by</i> steps
<code>max(<i>n1</i> <i>n2</i> ...)</code>	Maximum of the given arguments
<code>min(<i>n1</i> <i>n2</i> ...)</code>	Minimum of the given arguments
<code>mod(<i>x1</i> <i>x2</i>)</code>	<i>x1</i> modulo <i>x2</i> , that is, the integer remainder of dividing <i>x1</i> by <i>x2</i>
<code>round(n)</code>	Integer whose value is closest to n
<code>sqrt(n)</code>	Square root of n
Trigonometric Functions	
<code>sin(n)</code>	sine, argument n is in radians
<code>cos(n)</code>	cosine
<code>tan(n)</code>	tangent
<code>asin(n)</code>	arc sine, result is in radians
<code>acos(n)</code>	arc cosine
<code>atan(n)</code>	arc tangent

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Predefined Arithmetic Functions

Synopsis	Result
Random Number Generator	
<code>random(x)</code>	Returns a random integer between 0 and $x-1$. If <code>random</code> is called with no arguments, it returns an integer that has all of its bits randomly set.
<code>srandom(x)</code>	Sets the initial state of the random number generator to x .

abs

```
abs (  
    n_number  
)  
=> n_result
```

Description

Returns the absolute value of a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>n_result</i>	The absolute value of <i>n_number</i> .
-----------------	---

Example

```
abs ( -209.625)  
=> 209.625  
  
abs ( -23)  
=> 23
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

acos

```
acos( n_number
      )
    => f_result
```

Description

Returns the arc cosine of a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>f_result</i>	Returns the arc cosine of <i>n_number</i> .
-----------------	---

Example

```
acos(0.3)
=> 1.266104
```

add1

```
add1(  
    n_number  
)  
=> n_result
```

Description

Adds 1 to a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer to increase by 1.
-----------------	--

Value Returned

<i>n_result</i>	<i>n_number</i> plus 1.
-----------------	-------------------------

Example

```
add1( 59 )  
=> 60
```

Adds 1 to 59.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

asin

```
asin(  
    n_number  
)  
=> f_result
```

Description

Returns the arc sine of a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>f_result</i>	The arc sine of <i>n_number</i> .
-----------------	-----------------------------------

Example

```
asin(0.3)  
=> 0.3046927
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

atan

```
atan(  
    n_number  
)  
=> f_result
```

Description

Returns the arc tangent of a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>f_result</i>	The arc tangent of <i>n_number</i> .
-----------------	--------------------------------------

Example

```
atan(0.3)  
=> 0.2914568
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

COS

```
cos (  
    n_number  
)  
=> f_result
```

Description

Returns the cosine of a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>f_result</i>	The cosine of <i>n_number</i> .
-----------------	---------------------------------

Example

```
cos (0.3)  
=> 0.9553365  
  
cos (3.14/2)  
=> 0.0007963
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

exp

```
exp(  
    n_number  
)  
=> f_result
```

Description

Raises e to a given power.

Arguments

<i>n_number</i>	Power to raise e to.
-----------------	------------------------

Value Returned

<i>f_result</i>	The value of e raised to the power <i>n_number</i> .
-----------------	--

Example

```
exp( 1 )  
=> 2.718282  
  
exp( 3.0 )  
=> 20.08554
```

int

```
int(  
    n_arg  
)  
=> x_result
```

Description

Returns the largest integer not larger than the given argument.

Note: This function works on vector as well as waveform data. The function is applied to individual elements of the vector and waveform data.

Arguments

<i>n_arg</i>	A numeric value (which can be integer or floating point number).
--------------	--

Value Returned

<i>x_result</i>	The value of the largest integer not larger than the value specified by <i>n_arg</i> .
-----------------	--

Example

```
int( 3.01 )  
=> 3  
  
int( 3.99 )  
=> 3
```


linRg

```
linRg(  
    n_from n_to n_by  
)  
=> l_range / nil
```

Description

Returns a list of numbers in the linear range from *n_from* to *n_to* incremented by *n_by*.

Arguments

<i>n_from</i>	Smaller number in the linear range.
<i>n_to</i>	Larger number in the linear range.
<i>n_by</i>	Increment value when stepping through the range.

Value Returned

<i>l_range</i>	List of numbers in the linear range.
nil	Returned if error.

Example

```
range = linRg(-30 30 5)  
(-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

log

```
log(  
    n_number  
)  
=> f_result
```

Description

Returns the natural logarithm of a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>f_result</i>	The natural logarithm of <i>n_number</i> .
-----------------	--

Example

```
log( 3.0 )  
=> 1.098612
```

logRg

```
logRg(  
    n_from n_to n_by  
)  
=> l_range / nil
```

Description

Returns a list of numbers in the log10 range from *n_from* to *n_to* advanced by *n_by*.

The list is a geometric progression where the multiplier is 10 raised to the $1/n_{by}$ power. For example if *n_by* is 0.5, the multiplier is 10 raised to the 2nd power or 100.

Arguments

<i>n_from</i>	Smaller number in the linear range.
<i>n_to</i>	Larger number in the linear range.
<i>n_by</i>	Increment value when stepping through the range.

Value Returned

<i>l_range</i>	List of numbers in the linear range.
nil	Returned if error.

Example

```
logRg(1 1M 0.5)  
(1.0 100.0 10000.0 1000000.0)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

max

```
max (
    n_num1 n_num2 [ n_num3 ... ]
)
=> n_result
```

Description

Returns the maximum of the values passed in. Requires a minimum of two arguments.

Arguments

<i>n_num1</i>	First value to check.
<i>n_num2</i>	Next value to check.
[<i>n_num3</i> ...]	Additional values to check.

Value Returned

<i>n_result</i>	The maximum of the values passed in.
-----------------	--------------------------------------

Example

```
max(3 2 1)
=> 3

max(-3 -2 -1)
=> -1
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

min

```
min(  
    n_num1 n_num2 [ n_num3 ... ]  
)  
=> n_result
```

Description

Returns the minimum of the values passed in. Requires a minimum of two arguments.

Arguments

<i>n_num1</i>	First value to check.
<i>n_num2</i>	Next value to check.
[<i>n_num3</i> ...]	Additional values to check.

Value Returned

<i>n_result</i>	The minimum of the values passed in.
-----------------	--------------------------------------

Example

```
min(1 2 3)  
=> 1  
  
min(-1 -2.0 -3)  
=> -3.0
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

mod

```
mod(  
    x_integer1  
    x_integer2  
)  
=> x_result
```

Description

Returns the integer remainder of dividing two integers. The remainder is either zero or has the sign of the dividend.

Arguments

<i>x_integer1</i>	Dividend.
<i>x_integer2</i>	Divisor.

Value Returned

<i>x_result</i>	The integer remainder of the division. The sign is determined by the dividend.
-----------------	--

Example

```
mod(4 3)  
=> 1
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

random

```
random(  
    [ x_number ]  
)  
=> x_result
```

Description

Returns a random integer between 0 and *x_number* minus 1.

If you call `random` with no arguments, it returns an integer that has all of its bits randomly set.

Arguments

<i>x_number</i>	An integer.
-----------------	-------------

Value Returned

<i>x_result</i>	Returns a random integer between 0 and <i>x_number</i> minus 1.
-----------------	---

Example

```
random( 93 )  
=> 26
```

round

```
round(  
    n_arg  
)  
=> x_result
```

Description

Rounds a floating-point number to its closest integer value.

Arguments

<i>n_arg</i>	Floating-point number.
--------------	------------------------

Value Returned

<i>x_result</i>	The integer whose value is closest to <i>n_arg</i> .
-----------------	--

Example

```
round(1.5)  
=> 2  
  
round(-1.49)  
=> -1  
  
round(1.49)  
=> 1
```


sin

```
sin(  
    n_number  
)  
=> f_result
```

Description

Returns the sine of a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>f_result</i>	The sine of <i>n_number</i> .
-----------------	-------------------------------

Example

```
sin(3.14/2)  
=> 0.9999997  
  
sin(3.14159/2)  
=> 1.0
```

Floating-point results from evaluating the same expressions might be machine-dependent.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

sqrt

```
sqrt(  
    n_number  
)  
=> f_result
```

Description

Returns the square root of a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>f_result</i>	The square root of <i>n_number</i> .
-----------------	--------------------------------------

Example

```
sqrt( 49 )  
=> 7.0  
  
sqrt( 43942 )  
=> 209.6235
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

srandom

```
srandom(  
    x_number  
)  
=> t
```

Description

Sets the seed of the random number generator to a given number.

Arguments

<i>x_number</i>	An integer.
-----------------	-------------

Value Returned

t	This function always returns t.
---	---------------------------------

Example

```
srandom( 89 )  
=> t
```

sub1

```
sub1(  
    n_number  
)  
=> n_result
```

Description

Subtracts 1 from a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>n_result</i>	Returns <i>n_number</i> minus 1.
-----------------	----------------------------------

Example

```
sub1( 59 )  
=> 58
```

Subtracts 1 from 59.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

tan

```
tan(  
    n_number  
)  
=> f_result
```

Description

Returns the tangent of a floating-point number or integer.

Arguments

<i>n_number</i>	Floating-point number or integer.
-----------------	-----------------------------------

Value Returned

<i>f_result</i>	The tangent of <i>n_number</i> .
-----------------	----------------------------------

Example

```
tan( 3.0 )  
=> -0.1425465
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

xor

```
xor(  
    g_in1  
    g_in2  
)  
=> g_res
```

Description

Returns the XOR value of the boolean inputs.

Arguments

<i>g_in1</i>	The first boolean input.
<i>g_in2</i>	The second boolean input.

Value Returned

<i>g_res</i>	The resultant XOR value.
--------------	--------------------------

Example

```
xor(nil nil)  
=> nil  
xor(t nil)  
=> t  
xor(nil t)  
=> t  
xor(t t)  
=> nil
```

Waveform (Calculator) Functions

The calculator commands are described in this section.

average

```
average (
    o_waveform
    [ ?overall g_overall ]
    [ ?continuous g_continuous ]
)
=> n_average / o_waveformAverage / nil
```

Description

Computes the average of a waveform over its entire range.

If $y=f(x)$:

For a continuous signal, the average is calculated as the integral of the expression $f(x)$ over the range of x , divided by the range of x .

$$Average(y) = \frac{\int_{from}^{to} f(x)dx}{to - from}$$

For a discrete signal, the average is calculated by dividing the sum of all y values by the total number of data points.

$$Average(y) = \frac{\sum_{from}^{to} f(x)}{N}$$

where, $from$ is the initial value for x and to is the final value of x , and N is the total number of data points.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_waveform</code>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<code>?overall g_overall</code>	<p>Specifies whether to calculate the overall average across corners and sweeps. Possible values are <code>t</code> and <code>nil</code>.</p> <ul style="list-style-type: none">■ When the <code>overall</code> argument is set to <code>t</code>, the average is calculated across all corners and sweeps.■ When the <code>overall</code> argument is set to <code>nil</code>, the average is calculated per leaf. <p>The default value is <code>t</code>.</p>
<code>?continuous g_continuous</code>	<p>Specifies whether to calculate the average amplitude of the input waveform by considering it as a continuous signal or as a discrete signal. Possible values are:</p> <ul style="list-style-type: none">■ <code>t</code>: The waveform is considered as a continuous signal.■ <code>nil</code>: The waveform is considered as a discrete signal. <p>The default value is <code>t</code>.</p>

Value Returned

<code>n_average</code>	Returns a number representing the average value of the input waveform.
<code>o_waveformAverage</code>	Returns a waveform (or family of waveforms) representing the average value if the input is a family of waveforms.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
average( v( "/net9" ) )
```

Gets the average voltage (Y-axis value) of `/net9` over the entire time range specified in the simulation analysis.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

abs_jitter

```
abs_jitter(  
    o_waveform  
    t_crossType  
    n_threshold  
    [ ?xUnit t_xUnit ]  
    [ ?yUnit t_yUnit ]  
    [ ?Tnom n_Tnom ] )  
=> o_waveform / nil
```

Description

Calculates the absolute jitter values in the input waveform for the given threshold. The output waveform can be expressed in degrees, radians, or unit intervals (UI). The absolute jitter can be plotted as a function of cycle number, crossing time, or reference clock time.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_waveform</code>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX.</code>)
<code>t_crossType</code>	<p>The points at which the curves of the waveform intersect with the threshold. While intersecting, the curve may be either rising or falling.</p> <p>Valid values: <code>rising</code> and <code>falling</code>, respectively.</p> <p>Default <code>crossType</code> is <code>rising</code>.</p>
<code>n_threshold</code>	The threshold value against which the at which the input waveform intersects to calculate the absolute jitter.
<code>?xUnit t_xUnit</code>	<p>The unit defined for X-axis of the output waveform.</p> <p>Valid values: <code>s</code> (time) and <code>cycle</code>.</p> <p>Default: <code>s</code></p> <p>Cycle numbers refer to the n'th occurrence where the waveform crosses the given threshold.</p>
<code>?yUnit t_yUnit</code>	<p>The unit defined for Y-axis of the output waveform.</p> <p>Valid values: <code>rad</code> (radians), <code>UI</code> (unit intervals), and <code>s</code> (degrees)</p> <p>Default value: <code>rad</code>.</p>
<code>?Tnom n_Tnom</code>	<p>The nominal time period of the input waveform. The waveform is expected to be a periodic waveform that contains noise. If <code>Tnom</code> is <code>nil</code>, the <code>abs_jitter</code> function finds the approximate average time period of the input waveform.</p> <p>Default value: <code>nil</code>.</p>

Value Returned

<code>o_waveform</code>	Returns a waveform representing the absolute jitter value for the given threshold.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Example

```
abs_jitter(v("net9" "rising" 1.0 ?xUnit "cycle" ?yUnit "UI" )
```

Gets the absolute jitter /net9 for the threshold value 1.0. Tnom value is selected as nil.

analog2Digital

```
analog2Digital(  
    o_wave  
    t_thresholdType  
    [ ?vhi n_vhi ]  
    [ ?vlo n_vlo ]  
    [ ?vc n_vc ]  
    [ ?timeX n_timex ]  
)  
=> o_digWave / n_digval / nil
```

Description

Returns the digital form of the analog input, which can be a waveform, list or family of waveforms, or a string representation of expression(s).

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_wave</i>	Input waveform.
<i>t_thresholdType</i>	Can take the values <code>hilo</code> or <code>centre</code> . If <i>t_thresholdType</i> is <code>centre</code> , it is a high state (1) unless its value is less than <i>n_vc</i> , in which case it is a low state (0). If <i>t_thresholdType</i> is <code>hilo</code> , any value less than <i>n_vlo</i> is a low state (0), any value greater than <i>n_vhi</i> is a high state (1) and the rest is treated as unknown based on the value of <i>n_timex</i> .
?vhi <i>o_vhi</i>	High threshold value (used only when <i>t_thresholdType</i> is <code>hilo</code>). If you do not specify this value, it is calculated internally as: $vHigh = (topLine - bottomLine) * 0.6 + bottomline$
?vlo <i>o_vlo</i>	Low threshold value (used only when <i>t_thresholdType</i> is <code>hilo</code>). If you do not specify this value, it is calculated internally as: $vLow = (topLine - bottomLine) * 0.4 + bottomline$
?vc <i>o_vc</i>	Central threshold value (used only when <i>t_thresholdType</i> is <code>centre</code>). If you do not specify this value, it is calculated internally using <code>vCenter = average(wave)</code> .
?timeX <i>n_timeX</i>	The value that determines logic X. The <i>timeX</i> value is used to decide the state X. When threshold is <code>hilo</code> , the analog signal will be converted to logic X if: <ul style="list-style-type: none">■ analog signal value lies between <i>vHigh</i> and <i>vLow</i>■ lapse time between <i>vHigh</i> and <i>vLow</i> is larger than <i>timeX</i>

Value Returned

<i>o_digWave</i>	A waveform (or a list of waveforms) is returned if the analog input specified was <i>o_wave</i> .
<i>o_digVal</i>	A scalar value is returned if the analog input specified was <i>o_val</i> .
<i>nil</i>	Returns <i>nil</i> if the specified Waveform window does not exist.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Example

analog2Digital(v

```
analog2Digital(v("clk" ?result "tran" ?resultsDir "./mixed/test/adc_8bit.raw")  
"hilo" ?vHigh 1.78 ?vLow 0.2 ?timeX 1n)
```

awvCreateBus

```
awvCreateBus(  
    w_bus  
    l_wavelist  
    r_radix  
)
```

Definition

Creates a bus with the given digital signals and radix.

Arguments

<i>w_bus</i>	Name of the digital waveform representing a bus.
<i>l_wavelist</i>	List of the digital waveforms in the bus.
<i>r_radix</i>	Radix of the bus.

Value Returned

None.

Example

Following are the examples to create a digital binary bus with name *bus*.

```
awvCreateBus("bus" list( awvAnalog2Digital( v("/data<0> " ?result  
"tran-tran") nil nil 0.5 nil "centre")
```

```
awvAnalog2Digital( v("/datab<1> " ?result "tran-tran") nil nil 0.5  
nil "centre")
```

```
awvAnalog2Digital( v("/data<1> " ?result "tran-tran") nil nil 0.5 nil  
"centre")
```

```
awvAnalog2Digital( v("/datab<0> " ?result "tran-tran") nil nil 0.5  
nil "centre") ) "Binary")
```


awvPlaceXMarker

```
awvPlaceXMarker(  
    w_windowId  
    n_xLoc  
    [ ?subwindow x_subwindowId ]  
    [ ?label t_label ]  
)  
=> t_xLoc / t / nil
```

Description

Places a vertical marker at a specific x-coordinate in the optionally specified subwindow of the specified window.

Arguments

<i>w_windowId</i>	Waveform window ID.
<i>n_xLoc</i>	The x-coordinate at which to place the marker.
<i>?subwindow x_subwindowId</i>	Waveform subwindow ID.
<i>?label t_label</i>	

Value Returned

<i>t_xLoc</i>	Returns a string of x-coordinates if the command is successful and the vertical marker info form is opened.
<i>t</i>	Returns this when the command is successful but the vertical marker info form is not opened.
<i>nil</i>	Returns <i>nil</i> or an error message.

Example

```
awvPlaceXMarker( window 5) => "5"
```

Vertical marker info form is opened when the command is executed.

```
awvPlaceXMarker( window 6 ?subwindow 2) => t
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Vertical marker info form is not opened.

awvPlaceYMarker

```
awvPlaceYMarker(  
    w_windowId  
    n_yLoc  
    [ ?subwindow x_subwindowId ]  
    [ ?label t_label ]  
)  
=> t_yLoc / t / nil
```

Description

Places a horizontal marker at a specific y-coordinate in the optionally specified subwindow of the specified window.

Arguments

<i>w_windowId</i>	Waveform window ID.
<i>n_yLoc</i>	The y-coordinate at which to place the marker.
<i>?subwindow x_subwindowId</i>	Waveform subwindow ID.
<i>?label t_label</i>	

Value Returned

<i>t_yLoc</i>	Returns a string of y-coordinates if the command is successful and the horizontal marker info form is opened.
<i>t</i>	Returns this when the command is successful but the horizontal marker info form is not opened.
<i>nil</i>	Returns <i>nil</i> or an error message.

Example

- Places a horizontal marker with a label, *myHorizontalMarker1*, at *Y= 2.0* in the strip number 1 of the current subwindow of the current graph window:

```
awvPlaceYMarker(gw 2.0 ?label "myHorizontalMarker1" ?subwindow gsw ?stripNum  
1)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Where, `gw= awvGetCurrentWindow()` and `gsw= awvGetCurrentSubwindow(gw)`

- Places a horizontal marker with a label, `myHorizontalMarker2`, at `Y= 2.0` in the strip number 2 of the current subwindow of the current graph window:

```
awvPlaceYMarker(gw 2.0 ?label "myHorizontalMarker2" ?subwindow gsw ?stripNum 2)
```

Where, `gw= awvGetCurrentWindow()` and `gsw= awvGetCurrentSubwindow(gw)`

awvRefreshOutputPlotWindows

```
awvRefreshOutputPlotWindows(  
    s_session  
)
```

Description

Refreshes all existing plot windows (with new simulation data, if any) attached with the session *s_session*.

Arguments

<i>s_session</i>	Currently active environment variable.
------------------	--

Value Returned

None.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

b1f

```
b1f(  
    o_s11  
    o_s12  
    o_s21  
    o_s22  
)  
=> o_waveform / nil
```

Description

Returns the alternative stability factor in terms of the supplied parameters.

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.

Value Returned

<i>o_waveform</i>	Waveform object representing the alternative stability factor.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
s11 = sp(1 1)  
s12 = sp(1 2)  
s21 = sp(2 1)  
s22 = sp(2 2)  
plot(b1f(s11 s12 s21 s22))
```

bandwidth

```
bandwidth(  
    o_waveform  
    n_db  
    t_type  
)  
=> n_value / o_waveform / nil
```

Description

Calculates the bandwidth of a waveform.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_db</i>	Positive number that defines the bandwidth.
<i>t_type</i>	Type of input filter. Valid values: "low", "high" or "band".

Value Returned

<i>n_value</i>	Returns a number representing the value of the bandwidth if the input argument is a single waveform.
<i>o_waveform</i>	Returns a waveform (or family of waveforms) representing the bandwidth if the input argument is a family of waveforms.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
bandwidth( v( "/OUT" ) 3 "low" )
```

Gets the 3 dB bandwidth of a low-pass filter.

```
bandwidth( v( "/OUT" ) 4 "band" )
```

Gets the 4 dB bandwidth of a band-pass filter.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

clip

```
clip(  
    o_waveform  
    n_from  
    n_to  
    [?interpolate g_interpolate ]  
)  
=> o_waveform / nil
```

Description

Restricts the waveform to the range defined by *n_from* and *n_to*.

You can use the clip function to restrict the range of action of other commands. If *n_from* is nil, *n_from* is taken to be the first X value of the waveform, and if *n_to* is nil, *n_to* is taken to be the last x value of the waveform. If both *n_to* and *n_from* are nil, the original waveform is returned.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_from</i>	Starting value for the range on the X axis.
<i>n_to</i>	Ending value for the range on the X axis.
<i>?interpolate g_interpolate</i>	<p>Specifies whether to use the interpolated values for the <i>n_from</i> and <i>n_to</i> arguments in the clipped result when their specified values do not correspond to any actual data points. The default is <code>t</code>.</p> <p>If you set it to <code>nil</code>, the result will include only the actual data points between <i>n_from</i> and <i>n_to</i> values.</p>

Value Returned

<i>o_waveform</i>	Returns a waveform object if the input argument is a waveform object or returns a family of waveforms if the input argument is a family of waveforms.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
x = clip( v( "/net9" ) 2m 4m )
plot( x )
```

Plots the portion of a waveform that ranges from 2 ms to 4 ms.

```
plot( clip( v( "/net9" ) nil nil ) )
```

Plots the original waveform.

```
plot( clip( v( "/net9" ) nil 3m ) )
```

Plots the portion of a waveform that ranges from 0 to 3 ms.

clipX

```
clipX(  
    o_waveform  
    n_from  
    n_to  
)  
=> o_waveform / nil
```

Description

Restricts the waveform to the range defined by *n_from* and *n_to*.

The `clipX` function works in the same manner as the `clip` function, with an exception that `clipX` restricts the waveform within the range [*from*, *to*] without interpolating or extrapolating any values. In other words, `clipX` returns a waveform that consists only data points from the input waveform.

Note: The `clipX` function snaps the *from* and/or *to* values to a data point in the input waveform if these values are less than $1e-6 * \text{stepSize}$, where *stepSize* is the average step of the input waveform in range [*from*, *to*].

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_from</i>	Starting value for the range on the X axis.
<i>n_to</i>	Ending value for the range on the X axis.

Value Returned

<i>o_waveform</i>	Returns a waveform object if the input argument is a waveform object or returns a family of waveforms if the input argument is a family of waveforms.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

closeResults

```
closeResults(  
    t_dirName  
)  
=> t / nil
```

Definition

Closes the simulation results stored in the input results directory. The function closes all the internal resources opened by the tool that are related to the results directory. It is recommended that you must call this function before deleting a results directory, moving the directory to any other location, or renaming a results directory.

After calling the `closeResults` function, the OCEAN commands, such as `selectResults`, `getData`, `pv`, which can also be called without passing the `resultsDir` argument and run based upon previously called `openResults` call, stops working if called without passing the `resultsDir` argument.

Arguments

<code>t_dirName</code>	Name of the directory which was earlier used in the <code>openResults</code> function.
------------------------	--

Values Returned

<code>t</code>	If the results database has been closed successfully.
<code>nil</code>	If the results database has not been closed successfully.

compare

```
compare(  
    o_waveform1  
    o_waveform1  
    [ f_abstol [ f_reltol ] ]  
)  
=> o_comparisonWaveform / nil
```

Description

Compares the two given waveforms based on the specified values for absolute and relative tolerances. This function compares only the sections of the two waveforms where the X or independent axes overlap.

The following situations are possible:

- If neither relative nor absolute tolerance is specified, the function returns the difference of the two waveforms ($o_waveform1 - o_waveform2$).
- If only the absolute tolerance is specified, the function returns the difference of the two waveforms only when the absolute value of the difference is greater than the absolute tolerance ($|o_waveform1 - o_waveform2| > f_abstol$); otherwise it returns a zero waveform.
- If only the relative tolerance is specified, the function returns the difference of the two waveforms only when the absolute value of the difference is greater than the product of the relative tolerance and the larger of the absolute values of the two waveforms ($|o_waveform1 - o_waveform2| > f_reltol * \max(|o_waveform1|, |o_waveform2|)$); otherwise it returns a zero waveform.
- If both relative and absolute tolerances are specified, the function returns the difference of the two waveforms only when the absolute value of the difference is greater than the sum of the separately calculated tolerance components ($|o_waveform1 - o_waveform2| > f_abstol + f_reltol * \max(|o_waveform1|, |o_waveform2|)$); otherwise it returns a zero waveform.

Note: The function also compares parametric waveforms. However, for a successful comparison of parametric waveforms, the family tree structures of the two input waveforms should be the same. For both the input waveforms, the number of child waveforms at each level should also be the same, except at the leaf level where the elements are simple scalars. This is an obvious condition to obtain a meaningful comparison.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform1</i>	Waveform 1.
<i>o_waveform2</i>	Waveform 2.
<i>f_abstol</i>	Absolute tolerance. Default value: 0 . 0
<i>f_reltol</i>	Relative tolerance. Default value: 0 . 0

Value Returned

<i>o_comparisonWaveform</i>	Returns the difference of the two given waveforms based on the specified values of the relative and absolute tolerances.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
compare( wave1 wave2 2.2 0.4 )  
=> srrWave:175051528
```

Returns the difference of the waveforms *wave1* and *wave2* based on the specified absolute and relative tolerances of 2 . 2 and 0 . 4, respectively.

compression

```
compression(  
    o_waveform  
    [ ?x f_x ]  
    [ ?y f_y ]  
    [ ?compression f_compression ]  
    [ ?io s_measure ]  
    [ ?tanSlope t_tanSlope ]  
)  
=> f_compPoint / nil
```

Description

Performs an n th compression point measurement on a power waveform.

The `compression` function uses the power waveform to extrapolate a line of constant slope (dB/dB) according to a specified input or output power level. This line represents constant small-signal power gain (ideal gain). The function finds the point where the power waveform drops n dB from the constant slope line and returns either the X coordinate (input referred) value or the Y coordinate (output referred) value.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_waveform</code>	Waveform object representing output power (in dBm) versus input power (in dBm).
<code>?x f_x</code>	<p>The X coordinate value (in dBm) used to indicate the point on the output power waveform where the constant-slope power line begins. This point should be in the linear region of operation.</p> <p>Default value: Unless <code>f_y</code> is specified, defaults to the X coordinate of the first point of the <code>o_waveform</code> wave.</p>
<code>?y f_y</code>	<p>The Y coordinate value (in dBm) used to indicate the point on the output power waveform where the constant-slope power line begins. This point should be in the linear region of operation.</p> <p>Default value: Unless <code>f_x</code> is specified, defaults to the Y coordinate of the first point of the <code>o_waveform</code> wave.</p>
<code>?compression f_compression</code>	<p>The delta (in dB) between the power waveform and the ideal gain line that marks the compression point.</p> <p>Default value: 1</p>
<code>?io s_measure</code>	<p>Symbol indicating whether the measurement is to be input referred ('input') or output referred ('output').</p> <p>Default value: input</p>
<code>?tanSlope tanSlope</code>	Default value: 1

Value Returned

<code>f_compPoint</code>	Depending on the setting of <code>s_measure</code> , returns either input referred or output referred compression point.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
xloc = compression( wave ?x -25 ?compress 1)
yloc = compression( wave ?x -25 ?measure "Output")
; Each of following returns a compression measurement:
compression(dB20(harmonic(v("/Pif" ?result "pss_fd") 2)))
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

```
compression(dbm(harmonic(spectralPower(v("/Pif"
    ?result "pss_fd")/ 50.0
    v("/Pif" ?result "pss_fd"))) 2)))

compression(dbm(harmonic(spectralPower(v("/Pif"
    ?result "pss_fd")/resultParam("rif:r"
    ?result "pss_td") v("/Pif"
    ?result "pss_fd"))) 2)))

compression(dbm(harmonic(spectralPower(i("/rif/PLUS"
    ?result "pss_fd") v("/Pif" ?result "pss_fd"))) 2))
    ?x -25 ?compress 0.1 ?measure "Output")
```


compressionVRI

```
compressionVRI(  
    o_vport  
    x_harm  
    [ ?iport o_iport ]  
    [ ?rport f_rport ]  
    [ ?epoint f_epoint ]  
    [ ?gcomp f_gcomp ]  
    [ ?measure s_measure ]  
    [ ?format format ]  
)  
=> o_waveform / n_number / nil
```

Description

Performs an n th compression point measurement on a power waveform.

Use this function to simplify the declaration of a compression measurement. This function extracts the specified harmonic from the input waveform(s), and uses `dBm(spectralPower((i or v/r),v))` to calculate a power waveform. The function passes this power curve and the remaining arguments to the `compression` function to complete the measurement.

The `compression` function uses the power waveform to extrapolate a line of constant slope (dB/dB) according to a specified input or output power level. This line represents constant small-signal power gain (ideal gain). The function finds the point where the power waveform drops n dB from the constant slope line and returns either the X coordinate (input referred) value or the Y coordinate (output referred) value.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_vport</code>	Voltage across the output port. This argument must be a family of spectrum waveforms (1 point per harmonic) created by parametrically sweeping an input power (in dBm) of the circuit.
<code>x_harm</code>	Harmonic index of the voltage wave contained in <code>o_vport</code> . When <code>o_iport</code> is specified, also applies to a current waveform contained in <code>o_iport</code> .
<code>?iport o_iport</code>	Current into the output port. This argument must be a family of spectrum waveforms (1 point per harmonic) created by parametrically sweeping an input power (in dBm) of the circuit. When specified, the output power is calculated using voltage and current. Default value: <code>nil</code>
<code>?rport f_rport</code>	Resistance into the output port. When specified and <code>o_iport</code> is <code>nil</code> , the output power is calculated using voltage and resistance. Default value: 50
<code>?epoint f_epoint</code>	The X coordinate value (in dBm) used to indicate the point on the output power waveform where the constant-slope power line begins. This point should be in the linear region of operation. Default value: the X coordinate of the first point of the <code>o_waveform wave</code>
<code>?gcomp f_gcomp</code>	The delta (in dB) between the power waveform and the ideal gain line that marks the compression point. Default value: 1
<code>?measure s_measure</code>	Symbol indicating if measurement is to be input referred ('input') or output referred ('output'). Default value: <code>input</code>
<code>?format format</code>	Default Value: <code>power</code>

Value Returned

<code>o_waveform</code>	Returns a waveform when <code>o_waveform1</code> is a family of waveforms.
-------------------------	--

OCEAN Reference

Predefined and Waveform (Calculator) Functions

<i>f_number</i>	Returns a number when <i>o_waveform1</i> is a waveform.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

Each of the following returns a compression measurement:

```
compressionVRI(v("/Pif" ?result "pss_fd") 2)
compressionVRI(v("/Pif" ?result "pss_fd") 2
  ?rport resultParam("rif:r" ?result "pss_td"))
compressionVRI(v("/Pif" ?result "pss_fd") 2
  ?iport i("/rif/PLUS" ?result "pss_fd") ?epoint -25
  ?gcomp 0.1 ?measure "Output")
```

compressionVRICurves

```
compressionVRICurves(  
    o_vport  
    x_harm  
    [ ?iport o_iport ]  
    [ ?rport f_rport ]  
    [ ?epoint f_epoint ]  
    [ ?gcomp f_gcomp ]  
    [ ?format format ]  
)  
=> o_waveform / nil
```

Description

Constructs the waveforms associated with an n th compression measurement.

Use this function to simplify the creation of waveforms associated with a compression measurement. This function extracts the specified harmonic from the input waveform(s), and uses `dBm(spectralPower((i or v/r),v))` to calculate a power waveform.

The `compressionVRICurves` function uses the power waveform to extrapolate a line of constant slope (1dB/1dB) according to a specified input or output power level. This line represents constant small-signal power gain (ideal gain). The function shifts the line down by n dB and returns it, along with the power waveform, as a family of waveforms.

This function only creates waveforms and neither performs a compression measurement nor includes labels with the waveforms. Use the `compression` or `compressionVRI` function for making measurements.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_vport</code>	Voltage across the output port. This argument must be a family of spectrum waveforms (1 point per harmonic) created by parametrically sweeping an input power (in dBm) of the circuit.
<code>x_harm</code>	Harmonic index of the wave contained in <code>o_vport</code> . When <code>o_iport</code> is specified, also applies to a current waveform contained in <code>o_iport</code> .
<code>?iport o_iport</code>	Current into the output port. This argument must be a family of spectrum waveforms (1 point per harmonic) created by parametrically sweeping an input power (in dBm) of the circuit. When specified, the output power is calculated using voltage and current. Default value: <code>nil</code>
<code>?rport f_rport</code>	Resistance into the output port. When specified and <code>o_iport</code> is <code>nil</code> , the output power is calculated using voltage and resistance. Default value: 50
<code>?epoint f_epoint</code>	The X coordinate value (in dBm) used to indicate the point on the output power waveform where the constant-slope power line begins. This point should be in the linear region of operation. Default value: the X coordinate of the first point of the <code>o_waveform</code> wave
<code>?gcomp f_gcomp</code>	The delta (in dB) between the power waveform and the ideal gain line that marks the compression point. Default value: 1
<code>?format format</code>	Default Value: power

Value Returned

<code>o_waveform</code>	Returns a family of waveforms containing the output power and tangent line.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Example

Each of following examples returns curves related to a compression measurement:

```
compressionVRICurves(v("/Pif" ?result "pss_fd") 2)
compressionVRICurves(v("/Pif" ?result "pss_fd") 2
    ?rport resultParam("rif:r" ?result "pss_td"))
compressionVRICurves(v("/Pif" ?result "pss_fd") 2
    ?iport i("/rif/PLUS" ?result "pss_fd") ?epoint -25
    ?gcomp 0.1)
```

complex

```
complex(  
    f_real  
    f_imaginary  
)  
=> o_complex
```

Description

Creates a complex number of which the real part is equal to the real argument, and the imaginary part is equal to the imaginary argument.

Arguments

<i>f_real</i>	The real part of the complex number.
<i>f_imaginary</i>	The imaginary part of the complex number.

Value Returned

<i>o_complex</i>	Returns the complex number.
------------------	-----------------------------

Example

```
complex( 1.0 2.0 )  
=> complex( 1, 2 )
```

complexp

```
complexp(  
    g_value  
)  
=> t / nil
```

Description

Checks if an object is a complex number. The suffix *p* is added to the name of a function to indicate that it is a predicate function.

Arguments

<i>g_value</i>	A skill object.
----------------	-----------------

Value Returned

<i>t</i>	Returns <i>t</i> when <i>g_value</i> is a complex number.
<i>nil</i>	Returns <i>nil</i> if there is an error.

Example

```
complexp( (complex 0 1) )  
=> t  
  
complexp( 1.0 )  
=> nil
```


conjugate

```
conjugate(  
    { o_waveform | n_x }  
)  
=> o_waveform / n_y / nil
```

Description

Returns the conjugate of a waveform or number.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_x</i>	Complex or imaginary number.

Value Returned

<i>o_waveform</i>	Returns the conjugate of a waveform if the input argument is a waveform.
<i>n_y</i>	Returns the result of <i>n_x</i> being mirrored against the real axis (X axis) if the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

For this example, assume that the first three statements are true for the `conjugate` function that follows them.

```
x=complex(-1 -2)  
real(x) = -1.0  
imag(x) = -2.0  
conjugate(x) = complex(-1, 2)
```

Returns the conjugate of the input complex number.

convolve

```
convolve(  
    o_waveform1  
    o_waveform2  
    n_from  
    n_to  
    t_type  
    n_by  
)  
=> o_waveform /n_number /nil
```

Description

Computes the convolution of two waveforms.

Convolution is defined as

$$\int\limits_{from}^{to} f1(s)f2(t-s)ds$$

`f1` and `f2` are the functions defined by the first and second waveforms.

Note: The `convolve` function is numerically intensive and might take longer than the other functions to compute.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform1</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>o_waveform2</i>	Additional waveform object.
<i>n_from</i>	Starting point (X-axis value) of the integration range.
<i>n_to</i>	Ending point (X-axis value) of the integration range.
<i>t_type</i>	Type of interpolation. Valid values: "linear" or "log".
<i>n_by</i>	Increment.

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the convolution if one of the input arguments is a waveform. Returns a family of waveforms if either of the input arguments is a family of waveforms.
<i>n_number</i>	Returns a value representing the convolution if both of the input arguments are numbers.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
sinWave = expr( n sin( n ) linRg( 0 20 0.01 ) )
triWave = artListToWaveform( ' ( (-4, 0) (-3, 1) (-2, 0) (-1, -1) (0, 0)
( 1, 1) ( 2, 0) ( 3, -1) ( 4, 0) )
plot( convolve( sinWave triWave 0 10 "linear" 1 ) )
```

Gets the waveform from the convolution of the sine waveform and triangle waveform within the range of 0 to 10.

cPwrContour

```
cPwrContour(  
    o_iwave  
    o_vwave  
    x_harm  
    [ ?iwaveLoad o_iwaveLoad ]  
    [ ?vwaveLoad o_vwaveLoad ]  
    [ ?maxPower f_maxPower ]  
    [ ?minPower f_minPower ]  
    [ ?numCont x_numCont ]  
    [ ?refImp f_refImp ]  
    [ ?closeCont g_closeCont ]  
    [ ?modifier s_modifier ]  
    [ ?ifam ifam ]  
    [ ?vfam vfam ]  
)  
=> o_waveform / nil
```

Description

Constructs constant power contours for Z-Smith plotting. The trace of each contour correlates to reference reflection coefficients that all result in the same power level.

The *x_harm* harmonic is extracted from all the input waveforms. Power is calculated using the `spectralPower` function. The reference reflection coefficients are calculated using voltage, current, and a reference resistance.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_iwave</i>	Current used to calculate power, expected to be a two-dimensional family of harmonic waveforms.
<i>o_vwave</i>	Voltage used to calculate power, expected to be a two-dimensional family of harmonic waveforms.
<i>x_harm</i>	Harmonic index of the waves contained in <i>o_iwave</i> and <i>o_vwave</i> .
?iwaveLoad <i>o_iwaveLoad</i>	Current used to calculate reflection coefficient, expected to be a two-dimensional family of harmonic waveforms. Default value: <i>o_iwave</i>
?vwaveLoad <i>o_vwaveLoad</i>	Voltage used to calculate reflection coefficient, expected to be a two-dimensional family of harmonic waveforms. Default value: <i>o_vwave</i>
?maxPower <i>f_maxPower</i>	Maximum power magnitude value for contours. Default value: automatic
?minPower <i>f_minPower</i>	Minimum power magnitude value for contours. Default value: automatic
?numCont <i>x_numCont</i>	Total number of contours returned. Default value: 8
?refImp <i>f_refImp</i>	Reference resistance used to calculate reflection coefficients. Default value: 50
?closeCont <i>g_closeCont</i>	Boolean indicating when to close the contours. When <i>nil</i> , largest segment of each contour is left open. Default value: <i>nil</i>
?modifier <i>s_modifier</i>	Symbol indicating the modifier function to apply to the calculated power. The modifier function can be any single argument OCEAN function such as <i>db10</i> or <i>dBm</i> . Default value: <i>dbm</i>
?ifam <i>ifam</i>	
?vfam <i>vfam</i>	

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Value Returned

<i>o_waveform</i>	Returns a family of waveforms (contours) for Z-Smith plotting.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

The following example plots constant output power contours according to output:

```
cPwrContour(i("/I8/out" ?result "pss_fd") v("/net28"
?result "pss_fd")1)
```

The following example plots constant output power contours according to output reflection coefficients:

```
cPwrContour(i("/I8/out" ?result "pss_fd") v("/net28"
?result "pss_fd") 1 ?maxPower 0.002 ?minPower 0.001 ?numCont 9)
```

The following example plots constant input power contours according to output reflection coefficients:

```
cPwrContour(i("/C25/PLUS" ?result "pss_fd") v("/net30"
?result "pss_fd") 1 ?iwaveLoad i("/I8/out" ?result "pss_fd")
?vwaveLoad v("/net28" ?result "pss_fd") ?refImp 50.0
?numCont 9 ?modifier "mag")
```

cReflContour

```
cReflContour(  
    o_iwave  
    o_vwave  
    x_harm  
    [ ?iwaveLoad o_iwaveLoad ]  
    [ ?vwaveLoad o_vwaveLoad ]  
    [ ?maxRefl f_maxRefl ]  
    [ ?minRefl f_minRefl ]  
    [ ?numCont x_numCont ]  
    [ ?refImp f_refImp ]  
    [ ?closeCont g_closeCont ]  
)  
=> o_waveform / nil
```

Description

Constructs constant reflection coefficient magnitude contours for Z-Smith plotting. The trace of each contour correlates to reference reflection coefficients that all result in the same reflection coefficient magnitude.

The *x_harm* harmonic is extracted from all the input waveforms. Reflection coefficient magnitude is calculated using voltage, current, reference resistance, and the `mag` function. The reference reflection coefficients are calculated separately by using voltage, current, and a reference resistance.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_iwave</i>	Current used to calculate reflection coefficient magnitude, expected to be a two-dimensional family of spectrum waveforms.
<i>o_vwave</i>	Voltage used to calculate reflection coefficient magnitude, expected to be a two-dimensional family of spectrum waveforms.
<i>x_harm</i>	Harmonic index of the waves contained in <i>o_iwave</i> and <i>o_vwave</i> .
<i>?iwaveLoad</i> <i>o_iwaveLoad</i>	Current used to calculate reference reflection coefficient, expected to be a two-dimensional family of harmonic waveforms. Default value: <i>o_iwave</i>
<i>?vwaveLoad</i> <i>o_vwaveLoad</i>	Voltage used to calculate reference reflection coefficient, expected to be a two-dimensional family of spectrum waveforms. Default value: <i>o_vwave</i>
<i>?maxRefl</i> <i>f_maxRefl</i>	Maximum reflection coefficient magnitude value for contours. Default value: automatic
<i>?minRefl</i> <i>f_minRefl</i>	Minimum reflection coefficient magnitude value for contours. Default value: automatic
<i>?numCont</i> <i>x_numCont</i>	Total number of contours returned. Default value: 8
<i>?refImp</i> <i>f_refImp</i>	Reference resistance used to calculate reflection coefficients. Default value: 50
<i>?closeCont</i> <i>g_closeCont</i>	Boolean indicating when to close the contours. When <i>nil</i> , the largest segment of each contour is left open. Default value: <i>nil</i>

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Value Returned

<i>o_waveform</i>	Returns a family of waveforms (contours) for Z-Smith plotting.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

The following example plots constant output reflection coefficient contours according to output reflection coefficients:

```
cReflContour(i("/I8/out" ?result "pss_fd") v("/net28"
?result "pss_fd") 1)
```

The following example plots constant output reflection coefficient contours according to output reflection coefficients:

```
cReflContour(i("/I8/out" ?result "pss_fd") v("/net28"
?result "pss_fd") 1 ?maxRefl 0.7 ?minRefl 0.1 ?numCont 7)
```

The following example plots constant output reflection coefficient contours according to output reflection coefficients:

```
cReflContour(i("/C25/PLUS" ?result "pss_fd")
v("/net30" ?result "pss_fd") 1
?iwaveLoad i("/I8/out" ?result "pss_fd")
?vwaveLoad v("/net28" ?result "pss_fd") ?refImp 50.0
?numCont 9)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

cross

```
cross(  
    o_waveform  
    n_crossVal  
    x_n  
    s_crossType  
    [ g_multiple [ s_Xname ] ]  
)  
=> o_waveform / g_value / nil
```

Description

Computes the X-axis value at which a particular crossing of the specified edge type of the threshold value occurs.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_crossVal</i>	Y-axis value at which the corresponding values of X are calculated.
<i>x_n</i>	Number that specifies which X value to return. If <i>x_n</i> equals 1, the first X value with a crossing is returned. If <i>x_n</i> equals 2, the second X value with a crossing is returned, and so on. If you specify a negative integer for <i>x_n</i> , the X values with crossings are counted from right to left (from maximum to minimum). If you specify <i>x_n</i> equals 0, it returns all occurrences of the crossing events.
<i>s_crossType</i>	Type of the crossing. Valid values: 'rising', 'falling', 'either'.
<i>g_multiple</i>	An optional boolean argument that takes the value <code>nil</code> by default. If set to <code>t</code> , the value specified for the <i>x_n</i> argument is ignored and the function returns all occurrences of the crossing event.
<i>s_xName</i>	An optional argument that is used only when <i>g_multiple</i> is set to <code>t</code> . It takes the value <code>time</code> by default. It controls the contents of the x vector of the waveform object returned by the function. Valid values: 'time', 'cycle'

Value Returned

<i>o_waveform</i>	Returns a waveform if the input argument is a family of waveforms.
<i>g_value</i>	Returns the X-axis value of the crossing point if the input argument is a single waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
cross( v( "/net9" ) 2.5 2 'rising )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Gets the time value (X axis) corresponding to specified voltage `"/net9"=2.5V` (Y axis) for the second rising edge.

```
cross( v( "/net9" ) 1.2 1 'either )
```

Gets the time value (X axis) corresponding to specified voltage `"/net9"=1.2V` (Y axis) for the first edge, which can be a rising or falling edge.

```
cross(VT("/out") 2.5 0 0 t "time") (s)
```

Returns multiple occurrences of crossing events specified against time-points at which each crossing event occurs.

```
cross(VT("/out") 2.5 0 0 t "cycle") (s)
```

Returns multiple occurrences of crossing events specified against cycle numbers, where a cycle number refers to the n'th occurrence of the crossing event in the input waveform.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

db10

```
db10(  
    { o_waveform | n_number }  
)  
=> o_waveform / n_number / nil
```

Description

Returns 10 times the log10 of the specified waveform object or number. This function can also be written as dB10.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform object if the input argument is a waveform object or returns a family of waveforms if the input argument is a family of waveforms.
<i>n_number</i>	Returns a number if the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
db10( ymax( v( "/net9" ) ) )
```

Returns a waveform representing `log10(ymax(v("/net9")))` multiplied by 10.

```
db10( 1000 )  
=> 30.0
```

Gets the value `log10(1000)` multiplied by 10, or 30.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

db20

```
db20 (
    {o_waveform | n_number}
)
=> o_waveform / n_number / nil
```

Description

Returns 20 times the log10 of the specified waveform object or number. This function can also be written as dB20.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform object if the input argument is a waveform object or returns a family of waveforms if the input argument is a family of waveforms.
<i>n_number</i>	Returns a number if the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
db20( ymax( v( "/net9" ) ) )
```

Returns a waveform representing 20 times `log10(ymax(v("/net9")))`.

```
db20( 1000 )
=> 60.0
```

Returns the value of 20 times `log10(1000)`, or 60.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

dbm

```
dbm (
  { o_waveform | n_number }
)
=> o_waveform n_number / nil
```

Description

Returns 10 times the log10 of the specified waveform object plus 30. This function can also be written as dBm.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform object if the input argument is a waveform object or returns a family of waveforms if the input argument is a family of waveforms.
<i>n_number</i>	Returns a number if the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
dbm( ymax( v( "/net9" ) ) ) )
```

Returns a waveform representing 10 times `log10(ymax(v("/net9")))` plus 30.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

delay

```
delay(  
    [ ?wf1 o_waveform1 ]  
    [ ?value1 n_value1 ]  
    [ ?edge1 s_edge1 ]  
    [ ?nth1 x_nth1 ]  
    [ ?td1 n_td1 ]  
    [ ?wf2 o_waveform2 ]  
    [ ?value2 n_value2 ]  
    [ ?edge2 s_edge2 ]  
    [ ?nth2 x_nth2 ]  
    [ ?td2 n_td2 ]  
    [ ?td2r0 n_td2r0 ]}  
    [ ?stop n_stop ]  
    [ ?histoDisplay g_histoDisplay ]  
    [ ?noOfHistoBins x_noOfHistoBins ]  
    [ ?period1 period1 ]  
    [ ?period2 period2 ]  
    [ ?multiple multiple ]  
    [ ?xName xName ]  
    @rest args  
)  
=> o_waveform / n_value / nil
```

Description

Calculates the delay between a trigger event and a target event.

The `delay` command computes the delay between two points using the `cross` command.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>?wf1 o_waveform1</code>	First waveform object.
<code>?value1 n_value1</code>	Value at which the crossing is significant for the first waveform object.
<code>?edge1 s_edge1</code>	Type of the edge that must cross <i>n_value1</i> . Valid values: <code>rising</code> , <code>falling</code> , <code>either</code> Default Value: <code>either</code>
<code>?nth1 x_nth1</code>	Number that specifies which crossing is to be the trigger event. For example, if <i>x_nth1</i> is 2, the trigger event is the second edge of the first waveform with the specified type that crosses <i>n_value1</i> . Default Value: 1
<code>?td1 n_td1</code>	Time at which to start the delay measurement. The simulator begins looking for the trigger event, as defined by <i>o_waveform1</i> , <i>n_value1</i> , <i>t_edge1</i> , and <i>x_nth1</i> , only after the <i>n_td1</i> time is reached. Default Value: 0
<code>?wf2 o_waveform2</code>	Second waveform object.
<code>?value2 n_value2</code>	Value at which the crossing is significant for the second waveform.
<code>?edge2 s_edge2</code>	Type of the edge for the second waveform. Valid values: <code>rising</code> , <code>falling</code> , <code>either</code> Default Value: <code>either</code>
<code>?nth2 x_nth2</code>	Number that specifies which crossing is to be the target event. For example, if <i>x_nth2</i> is 2, the target event is the second edge of the second waveform with the specified type that crosses <i>n_value2</i> . Default Value: 1

OCEAN Reference

Predefined and Waveform (Calculator) Functions

?td2 *n_td2*

Time to start observing the target event. *n_td2* is specified relative to the trigger event. This parameter cannot be specified at the same time as *n_td2r0*.

The simulator begins looking for the target event, as defined by *o_waveform2*, *n_value2*, *t_edge2*, and *x_nth2*, only after the *n_td2* time is reached

If you specify neither *n_td2* nor *n_td2r0*, the simulator begins looking for the target event at $t = 0$.

Note: For non- multiple, If *td2* is specified, find the cross point of *wf1* at edge *nth*. Use this as trigger point for *target(wf2)* and ignore *wf2* before *wf1* trigger event to find its cross point. Calculate the delay between two cross points. If *td2* is not specified, find the cross point at edge *nth1* of *wf1* and cross point of edge *nth2* of *wf2* with target at time at $t=0$ and calculate the delay between two cross points.

?td2r0 *n_td2r0*

Time to start observing the target event, relative to $t = 0$. Only applicable if both *o_waveform1* and *o_waveform2* are specified. This parameter cannot be specified at the same time with *n_td2*.....The simulator begins looking for the target event, as defined by *o_waveform2*, *n_value2*, *t_edge2*, and *x_nth2*, only after the *n_tdr0* time is reached.

If you specify neither *n_td2* nor *n_td2r0*, the simulator begins looking for the target event at $t = 0$.

?td2 and ?td2r0 take precedence over other options.

?stop *n_stop*

Time to stop observing the target event.

?histoDisplay *g_histoDisplay*

When set to *t*, returns a waveform that represents the statistical distribution of the riseTime data in the form of a histogram. The height of the bars (bins) in the histogram represents the frequency of the occurrence of values within the range of riseTime data.

Valid values: *t nil*

Default value: *nil*

OCEAN Reference

Predefined and Waveform (Calculator) Functions

`?noOfHistoBins` *x_noOfHistoBins*

Denotes the number of bins represented in the histogram representation.

Valid values: Any positive integer

Default value: 1

`?period1` *period1*

Periodic interval for the first waveform.

`?period2` *period2*

Periodic interval for the second waveform.

`?multiple` *multiple*

Finds all the cross points of `wf1`. If `td2` is specified, finds cross points of `target(wf2)` starting at trigger event (first cross point of `wf1`) and ignore `wf2` before `wf1` trigger event. If `td2` is not specified, finds cross points of `target(wf2)` at time at `t=0`. Calculate the delay between each of the cross points falling at interval of `period1` and `period2` of `wf1` and `wf2` respectively.

`?xName` *xName*

Specifies whether you want to retrieve delay data against *trigger* time, *target* time (or another X-axis parameter for non-transient data) or *cycle*. Cycle numbers refer to the n'th occurrence of the delay event in the input waveform.

The value in this field is ignored when you specify *Number of Occurences* as *single*.

`@Rest` *args*

Variable list of arguments passed to the `delay` function (as created from the Calculator UI). These variables also include support for multiple occurrences of the delay event.

Note: `g_histoDisplay` and `x_noOfHistoBins` are added for backward compatibility only. It will be deprecated in future releases. Use the `histo` function for plotting the histogram of the resulting function.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Value Returned

<i>o_waveform</i>	Returns a waveform representing the delay if the input argument is a family of waveforms.
<i>n_value</i>	Returns the delay value if the input argument is a single waveform.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
delay(?wf1 v("16" ?result "tran"), ?value1 2.5, ?edge1 "rising", ?nth1 1, ?td1 0.0,
?wf2 v("1" ?result "tran"), ?value2 2.5, ?edge2 "rising", ?nth2 1, ?td2 nil, ?stop
nil, ?period1 1 ?period2 1 ?multiple t ?xName "trigger" )
```

Calculates the delay between two waveforms *wf1* and *wf2* with the argument values specified as above.

```
delay( ?wf1 wf1 ?value1 2.5 ?nth1 2 ?edge1 'either ?wf2 wf2 ?value2 2.5 ?nth2 1
?edge2 'falling )
```

Calculates the delay starting from the time when the second edge of the first waveform reaches the value of 2.5 to the time when the first falling edge of the second waveform crosses 2.5.

```
delay( ?td1 5 ?wf2 wf2 ?value2 2.5 ?nth2 1 ?edge2 'rising ?td2 5)
```

Calculates the delay starting when the time equals 5 seconds and stopping when the value of the second waveform reaches 2.5 on the first rising edge 5 seconds after the trigger.

```
delay( ?wf1 wf1 ?value1 2.5 ?nth1 1 ?edge1 'rising ?td1 5 ?wf2 wf2 ?value2 2.5 ?nth2
1 ?edge2 'rising ?td2 0)
```

Waits until after the time equals 5 seconds, and calculates the delay between the first and the second rising edges of *wf2* when the voltage values reach 2.5.

```
delay(VT("/out"), 2.5, 1, 'rising, VT("/in"), 2.5, 1, 'rising', 1, 1, t)
```

Computes the delay between the rising edges of *VT("/out")* and *VT("/in")* when the waveforms cross their respective threshold values (that is, 2.5).

```
delay(VT("/out") 1.5 1 "rising" VT("/out") 1.5 2 "rising" 1 1 t "trigger") (s)
```

Returns multiple occurrences of delay specified against trigger time-points at which each delay event occurs.

```
delay(VT("/out") 1.5 1 "rising" VT("/out") 1.5 2 "rising" 1 1 t "target") (s)
```

Returns multiple occurrences of delay specified against target time-points at which each delay event occurs.

```
delay(VT("/out") 1.5 1 "rising" VT("/out") 1.5 2 "rising" 1 1 t "cycle") (s)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Returns multiple occurrences of delay specified against cycle numbers, where a cycle number refers to the n'th occurrence of the delay event in the input waveform.

delayMeasure

```
delayMeasure(  
    o_waveform1  
    o_waveform2  
    [ ?edge1 s_edge1 ]  
    [ ?nth1 x_nth1 ]  
    [ ?value1 n_value1 ]  
    [ ?edge2 s_edge2 ]  
    [ ?nth2 x_nth2  
    [ ?value2 n_value2 ]  
=> n_value / nil
```

Description

Calculates the delay between a trigger event and a target event.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>?wf1 o_waveform1</code>	First waveform object.
<code>?wf2 o_waveform2</code>	Second waveform object.
<code>?edge1 s_edge1</code>	Type of the edge that must cross <i>n_value1</i> . Valid values: rising, falling, either Default Value: either
<code>?nth1 x_nth1</code>	Number that specifies which crossing is to be the trigger event. For example, if <i>x_nth1</i> is 2, the trigger event is the second edge of the first waveform with the specified type that crosses <i>n_value1</i> . Default Value: 1
<code>?value1 n_value1</code>	Threshold value at which the crossing is significant for the first waveform object. If this value is <code>nil</code> or blank, threshold is calculated internally using <code>average(wave1)</code>
<code>?edge2 s_edge2</code>	Type of the edge for the second waveform. Valid values: rising, falling, either Default Value: either
<code>?value2 n_value2</code>	Threshold value at which the crossing is significant for the second waveform. If this value is <code>nil</code> or blank, threshold is calculated internally using <code>average(wave2)</code> .
<code>?nth2 x_nth2</code>	Number that specifies which crossing is to be the target event. For example, if <i>x_nth2</i> is 2, the target event is the second edge of the second waveform with the specified type that crosses <i>n_value2</i> . Default Value: 1

Example

```
delayMeasure(wave1 wave2)
```

Calculates the delay between the two waveforms, `wave1` and `wave2`.

```
delayMeasure( wave1 wave2 ?value1 2.5 ?nth1 2 ?edge1 'either ?wf2 wf2 ?value2 2.5  
?nth2 1 ?edge2 'falling )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Calculates the delay starting from the time when the second edge of the first waveform reaches the value of 2.5 to the time when the first falling edge of the second waveform crosses 2.5.

deriv

```
deriv(  
    o_waveform  
)  
=> o_waveform / nil
```

Description

Computes the derivative of a waveform with respect to the X axis.

Note the following:

- After the second derivative, the results become inaccurate because the derivative is obtained numerically.
- Use the magnitude value instead of dB in frequency domain.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the derivative with respect to the X axis of the input waveform. Returns a family of waveforms if the input argument is a family of waveforms.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot( deriv( VT( "/net8" ) ) ) )
```

Plots the waveform representing the derivative of the voltage of `"/net8"`.

```
plot( deriv( mag(VF( "/OUT" ) ) ) ) )
```

Plots the waveform representing the derivative of the frequency of `"/OUT"`.

dft

```
dft(  
    o_waveform  
    n_from  
    n_to  
    x_num  
    [ t_windowName ]  
    [ n_param1 ]  
    [ coherentGain ]  
    [ n_adcSpan ]  
)  
=> o_waveform / nil
```

Description

Computes the discrete Fourier transform and fast Fourier transform of the input waveform.

The waveform is sampled at the following n timepoints:

```
from, from + deltaT, from + 2 * deltaT,...,  
from + (N - 1) * deltaT
```

The output of `dft` is a frequency waveform, $W(f)$, which has $(N/2 + 1)$ complex values—the DC term, the fundamental, and $(N/2 - 1)$ harmonics.

Note: The last time point, $(from + (N - 1) * deltaT)$, is $(to - deltaT)$ rather than to . The `dft` command assumes that $w(from)$ equals $w(to)$.

The DFT function assumes that $w(from)$ equals to $w(to)$. A warning message appears when $w(from)$ is not equal to $w(to)$ in the following situation:

window function is `Rectangular` or not specified, and

$|w(from) - w(to)| > 1e-3 * range(w)$,

where, $range(w)$ is $max(w) - min(w)$ in $[from, to]$

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_from</i>	Starting value for the <code>dft</code> computation.
<i>n_to</i>	Ending value for the <code>dft</code> computation.
<i>x_num</i>	Number of timepoints.
<i>t_windowName</i>	<p>Variable representing different methods for taking a <code>dft</code> computation.</p> <p>Valid values: Rectangular, ExtCosBell, HalfCycleSine, Hanning or Cosine2, Triangle or Triangular, Half3CycleSine or HalfCycleSine3, Hamming, Cosine4, Parzen, Half6CycleSine or HalfCycleSine6, Blackman, Kaiser, or Nuttall.</p> <p>For more information about <i>windowName</i>, see the information about Discrete Fourier Transform (dft) in the <u><i>Virtuoso Analog Design Environment L User Guide</i></u>.</p>
<i>n_param1</i>	<p>Smoothing parameter.</p> <p>Applies only if the <i>t_windowName</i> argument is set to Kaiser.</p>
<i>n_coherentGain</i>	<p>When you apply the function <code>dft</code>, the applied window type (besides the rectangular type) changes the signal's amplitude. Applying a coherent gain factor is a way to get consistent results regardless of the window type.</p> <p>The default value is 1.</p>
<i>n_adcSpan</i>	<p>Specifies the peak saturation level of the FFT waveform. When specified the magnitude of the input waveform is divided by <code>adc span</code> value before computing FFT. This is full-scale span ignoring any DC offsets.</p> <p>Valid values : Any floating point number</p> <p>Default Value : 1.0</p>

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Value Returned

<i>o_waveform</i>	Returns a waveform representing the magnitude of the various harmonics for the specified range of frequencies. Returns a family of waveforms if the input argument is a family of waveforms.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Examples

The following example creates the waveform object `waveDFT`, representing the discrete Fourier transform, fast Fourier transform, of the waveform representing the voltage of the net "in". The computation is done from 0n to 20n with 64 timepoints.

```
openResults("./simulation/vdr_demo/inverter_chain/maestro/results/maestro/
Interactive.1/psf/vdr_demo:inverter_chain_test:1/psf")
;Opens the simulation results stored in the specified results directory.
results()
; Lists the available results in the currently selected results directory.
selectResults('tran')
; Selects the result tran
outputs()
; Lists the outputs available in the selected result.
v=v("in")
;Creates a waveform object v, which represents the voltage waveform of the net 'in'.
This is the input waveform to which the function 'dft' will be applied.
waveDFT=dft(v 0 20 64 "HalfCycleSine" 1 2 2.0)
; Creates the waveform object waveDFT, representing the discrete Fourier transform,
fast Fourier transform, of the waveform representing the voltage of the net "in".
The computation is done from 0n to 20n with 64 timepoints.
window=awvCreatePlotWindow()
; Creates the waveform window.
awvPlotWaveform(
    window
    list(v waveDFT)
    ?expr list("inputWave" "outputWave")
    ?color list("y1" "y66")
    ?index list(1 2)
    ?lineType list("line" "line")
)
; Plots the inputWaveform v and output waveform waveDFT in the specified waveform
window.
```

OCEAN Reference

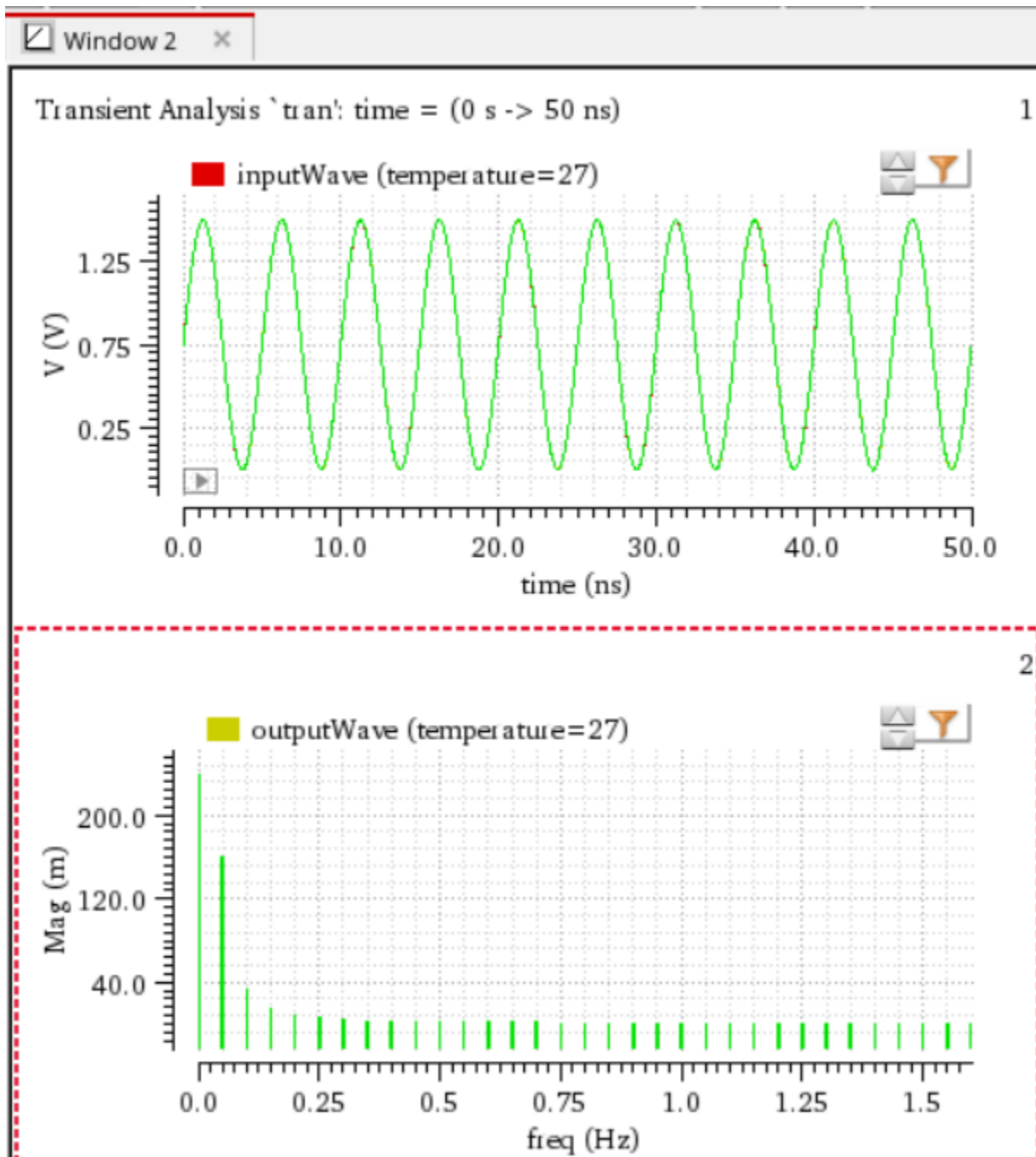
Predefined and Waveform (Calculator) Functions

```
=> "./simulation/vdr_demo/inverter_chain/maestro/results/maestro/Interactive.1/
psf/vdr_demo:inverter_chain_test:17psf"
=>
tran(tranOp model instance output designParamVals
      primitives subckts variables
)
=> stdobj@0x37375c80
=>
("/net7" "/net5" "/net6" "/out" "/in"
)
=> srrWave:0x3cd2d180
=> srrWave:0x3cd2d190
=> window:5
```

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Predefined and Waveform (Calculator) Functions

=> t



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Predefined and Waveform (Calculator) Functions

dftbb

```
dftbb(  
    o_waveform1  
    o_waveform2  
    f_timeStart  
    f_timeEnd  
    x_num  
    [ ?windowName t_windowName ]  
    [ ?smooth x_smooth ]  
    [ ?cohGain f_cohGain ]  
    [ ?spectrumType s_spectrumType ]  
)  
=> o_waveformComplex / nil
```

Description

Computes the discrete Fourier transform (fast Fourier transform) of a complex signal.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform1</i>	Time domain waveform object with units of volts or amps.
<i>o_waveform2</i>	Time domain waveform object with units of volts or amps.
<i>f_timeStart</i>	Start time for the spectral analysis interval. Use this parameter and <i>f_timeEnd</i> to exclude part of the interval. For example, you might set these values to discard initial transient data.
<i>f_timeEnd</i>	End time for the spectral analysis interval.
<i>x_num</i>	The number of time domain points to use. The maximum frequency in the Fourier analysis is directly proportionate to <i>x_num</i> and inversely proportional to the difference between <i>f_timeStart</i> and <i>f_timeEnd</i> .
<i>?windowName</i> <i>t_windowName</i>	<p>The window to be used for applying the moving window FFT.</p> <p>Valid values: Rectangular, ExtCosBell, HalfCycleSine, Hanning, Cosine2, Triangle or Triangular, Half3CycleSine or HalfCycleSine3, Hamming, Cosine3, Cosine4, Parzen, Half6CycleSine or HalfCycleSine6, Blackman, Kaiser, or Nuttall.</p> <p>Default value: Rectangular.</p>
<i>?smooth x_smooth</i>	<p>The Kaiser window smoothing parameter. If there are no requests, there is no smoothing.</p> <p>Valid values: 0 <= <i>x_smooth</i> <= 15</p> <p>Default value: 1</p>
<i>?cohGain f_cohGain</i>	<p>A scaling parameter. A non-zero value scales the power spectral density by 1/(<i>f_cohGain</i>).</p> <p>Valid values: 0 <= <i>f_cohGain</i> <= 1. You can use 1 if you do not want the scaling parameter to be used.</p> <p>Default value: 1</p>

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Predefined and Waveform (Calculator) Functions

<code>?spectrumType</code> <code>t_spectrumType</code>	A string that can be either <code>singleSided</code> or <code>doubleSided</code> . When this option is single-sided, the resultant waveform is only on one side of the y axis starting from 0 to N-1. When it is double-sided, it is symmetric to the Y axis from -N/2 to (N/2) -1. Default value: <code>SingleSided</code>
---	--

Value Returned

<code>o_waveformComplex</code> <code>nil</code>	The discrete Fourier transform for baseband signals of the two waveforms returned when the command is successful. Returns <code>nil</code> and an error message otherwise.
--	---

Example

```
dftbb(VT("/net32") VT("/net11") , 0, 16m, 12000, ?windowName 'Hanning,?smooth 1,  
?cohGain 1, ?spectrumType "SingleSided")
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

dnl

```
dnl(  
  o_dacSignal  
  o_sample | o_pointList | n_interval  
  [ ?mode t_mode ]  
  [ ?threshold n_threshold ]  
  [ ?crossType t_crossType ]  
  [ ?delay f_delay ]  
  [ ?method t_method ]  
  [ ?units x_units ]  
  [ ?nbsamples n_nbsamples ]  
)  
=> n_dnl / nil
```

Description

Computes the differential non-linearity of a transient simple or parametric waveform.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_dacSignal</code>	Waveform for which the differential non-linearity is to be calculated.
<code>o_sample</code>	Waveform used to obtain the points for sampling the <code>dacSignal</code> . These are the points at which the waveform crosses the threshold while either <code>rising</code> or <code>falling</code> (defined by the <code>crossType</code> argument) with the <code>delay</code> added to them.
<code>n_pointList</code>	List of domain values at which the sample points are obtained from the <code>dacSignal</code> .
<code>n_interval</code>	The sampling interval.
<code>?mode t_mode</code>	<p>The mode for calculating the threshold.</p> <p>Valid values: <code>auto</code> and <code>user</code>. Default value: <code>auto</code>.</p> <p>If set to <code>user</code>, an <code>n_threshold</code> value needs to be provided.</p> <p>If set to <code>auto</code>, <code>n_threshold</code> is calculated internally.</p>
<code>?threshold n_threshold</code>	The threshold value against which the differential non-linearity is to be calculated. It needs to be specified only when the <code>mode</code> is selected as <code>user</code> .
<code>?crossType t_crossType</code>	<p>The points at which the curves of the waveform intersect with the threshold. While intersecting, the curve may be either <code>rising</code> or <code>falling</code>.</p> <p>Valid values: <code>rising</code> and <code>falling</code>, respectively.</p> <p>Default <code>crossType</code> is <code>rising</code>.</p>
<code>?delay f_delay</code>	<p>The delay time after which the sampling begins.</p> <p>Valid values: Any valid time value.</p> <p>Default value: <code>0</code>.</p>
<code>?method t_method</code>	<p>The method to be used for calculation.</p> <p>Valid values: <code>end</code> (end-to-end) and <code>fit</code> (straight line).</p> <p>Default value: <code>end</code>.</p>

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Predefined and Waveform (Calculator) Functions

<code>?units x_units</code>	Unit for expressing the output waveform. Valid values: <code>abs</code> (absolute) and <code>lsb</code> (multiples of least significant bit). Default value: <code>abs</code> .
<code>?nbsamples n_nbsamples</code>	Number of samples used for calculating the non-linearity. If not specified, the samples are taken against the entire data window.

Note: For each of the three ways in which the sample points can be specified, only a few of the other optional arguments are meaningful, as indicated below:

- For `o_sample`, the arguments `t_mode`, `n_threshold`, `t_crossType`, `f_delay`, `t_method`, and `x_units` are meaningful.
- For `n_pointList`, the arguments `t_method` and `x_units` are meaningful.
- For `n_interval`, the arguments `t_method`, `x_units`, and `n_nbsamples` are meaningful.

Value Returned

<code>n_dnl</code>	Returns the differential waveform.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
dnl( wave1 wave2 ?crossType "rising" ?delay 0.4 )
=> srrWave:175051544
```

Returns the differential non-linearity for `wave1` by taking the points at which `wave2` crosses the internally calculated threshold while `rising` as the sample points and adding a delay of `0.4` to them.

dutyCycle

```
dutyCycle(  
    o_waveform  
    [ ?threshold n_threshold ]  
    [ ?xName t_xName ]  
    [ ?outputType t_outputType ]  
    [ ?mode mode ]  
)  
=> o_waveform / f_average / nil
```

Description

Computes the duty cycle for a given waveform as a function of time or cycle.

Note: Duty cycle is the ratio of the time for which the signal remains ‘high’ and the time period of the signal.

Arguments

<code>o_waveform</code>	Waveform, expression, or a family of waveforms.
<code>?threshold n_threshold</code>	The threshold value. It needs to be specified only when the <i>mode</i> is selected as <i>user</i> .
<code>?xName t_xName</code>	The X-axis of the output waveform. Valid values: <i>time</i> and <i>cycle</i> . Default value: <i>time</i> .
<code>?outputType t_outputType</code>	Type of output. Valid values: <i>average</i> and <i>plot</i> . If set to <i>average</i> , the output is an average value. If set to <i>plot</i> , the output is a waveform. In both the cases, the output is expressed in terms of a percentage. Default value: <i>plot</i> .

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Predefined and Waveform (Calculator) Functions

?mode *t_mode*

The mode used to calculate the threshold value.

Valid values: `auto` and `user`.

Default value: `auto`.

If you want to specify the threshold value, set the variable to `user`. If you want Virtuoso Visualization and Analysis XL to calculate the threshold value, set the variable to `auto`.

The Auto Threshold Value is calculated as the average which is integral of the waveform divided by the X range.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Value Returned

<i>o_waveform</i>	Returns a waveform that represents duty cycle as a function of time.
<i>f_average</i>	Returns the average duty cycle value as a percentage.
<i>nil</i>	Returns <i>nil</i> if the duty cycle cannot be calculated.

Example

```
dutyCycle( wave1 )  
=> srrWave:175051552
```

Returns the duty cycle as a function of time for the wave *wave1*.

```
dutyCycle( wave1 ?outputType "average" )  
=> 52.1066
```

Returns the average (in percentage) of the duty cycle values for the wave *wave1*.

evmQAM

```
evmQAM(  
    o_waveformI  
    o_waveformQ  
    n_tDelay  
    n_samplingT  
    x_levels  
    g_normalize  
    [ ?percent d_percent ]  
)  
=> o_waveform / nil
```

Description

Processes the I and Q waveform outputs from the transient simulation run to calculate the Error Vector Magnitude (EVM) for multi-mode modulations. The function plots the I versus Q scatterplot. EVM is a useful measurement to describe the overall signal amplitude and phase modulated signal quality. It is based on a statistical error distribution normalized from an ideal digital modulation. Quadrature Amplitude Modulation (QAM) is a typical modulation scheme where EVM is useful. The EVM is calculated by detecting the I and Q signal levels corresponding to the four possible I and Q symbol combinations and calculating the difference between the actual signal level and the ideal signal level.

Note: This function is not supported for families of waveforms.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveformI</i>	The waveform for the I signal.
<i>o_waveformQ</i>	The waveform for the Q signal.
<i>n_tDelay</i>	The start time (a numerical value) for the first valid symbol. This can be obtained from the Waveform Viewer window by recording the time of the first minimum or first maximum (whichever is earlier) on the selected signal stream.
<i>n_samplingT</i>	A sampling time (a numerical value) for the symbol. Each period is represented by a data rate. The data rate at the output is determined by the particular modulation scheme being used.
<i>x_levels</i>	<p>The modulation levels.</p> <p>Valid values: 4, 16, 64, 256</p> <p>Default value: 4</p>
<i>g_normalize</i>	<p>An option to see the scatter plot normalized to the ideal values +1 and -1 (for example, when superimposing scatter plots from different stages in the signal flow, where the levels may be quite different but you want to see relative degradation or improvement in the scatter). This option does not affect the calculation of the EVM number.</p> <p>Valid values: <i>nil</i>, <i>t</i></p> <p>Default value: <i>t</i></p>
<i>?percent d_percent</i>	

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the EVM value computed from the input waveforms.
<i>nil</i>	Returns <i>nil</i> and an error message if the function is unsuccessful.

Example

```
evmQAM( v("samp_out_Q"), v("samp_out_I") 1.5u, 181.81n, 4, t )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Calculates the EVM value for the modulation level $\frac{4}{3}$ in normalized form.

evmQpsk

```
evmQpsk(  
    o_waveform1  
    o_waveform2  
    n_tDelay  
    n_sampling  
    g_autoLevelDetect  
    n_voltage  
    n_offset  
    g_normalize  
    [ ?percent d_percent ]  
)  
=> o_waveform / nil
```

Description

Processes the I and Q waveform outputs from the transient simulation run to calculate the Error Vector Magnitude (EVM) and plot the I versus Q scatterplot. EVM is a useful measurement to describe the overall signal amplitude and phase modulated signal quality. It is based on a statistical error distribution normalized from an ideal digital modulation. Quadrature Phase Shift Keying (QPSK) is a typical modulation scheme where EVM is useful. The EVM is calculated by detecting the I and Q signal levels corresponding to the four possible I and Q symbol combinations and calculating the difference between the actual signal level and the ideal signal level.

Note: This function is not supported for families of waveforms.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform1</i>	The waveform for the I signal.
<i>o_waveform2</i>	The waveform for the Q signal.
<i>n_tDelay</i>	The start time for the first valid symbol. This can be obtained from the Waveform Viewer window by recording the time of the first minimum or first maximum (whichever is earlier) on the selected signal stream.
<i>n_sampling</i>	A period for the symbol. Each period is represented by a data rate. The data rate at the output is determined by the particular modulation scheme being used.
<i>g_autoLevelDetect</i>	<p>An option to indicate that you want the amplitude (<i>n_voltage</i>) and DC offset (<i>n_offset</i>) to be automatically calculated. Amplitude is calculated by averaging the rectified voltage level of the signal streams and DC offset by averaging the sum of an equal number of positive and negative symbols in each signal stream. These values are used to determine the EVM value. If this value is set to <i>nil</i>, you must specify values for <i>n_voltage</i> and <i>n_offset</i>.</p> <p>Valid values: <i>'nil, 't</i></p> <p>Default value: <i>'t</i></p>
<i>n_voltage</i>	The amplitude of the signal.
<i>n_offset</i>	The DC offset value.
<i>g_normalize</i>	<p>An option to see the scatter plot normalized to the ideal values +1 and -1 (for example, when superimposing scatter plots from different stages in the signal flow, where the levels may be quite different but the you want to see relative degradation or improvement in the scatter). This option does not affect the calculation of the EVM number.</p> <p>Valid values: <i>nil, t</i></p> <p>Default value: <i>nil</i></p>
<i>?percent d_percent</i>	

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the EVM value computed from input waveforms.
<i>nil</i>	Returns <i>nil</i> and an error message if the function is unsuccessful.

Example

```
evmQpsk( v("samp_out_Q"), v("samp_out_I") 1.5u, 181.81n, t, nil, nil, nil)
```

Calculates the EVM value when *g_autoLevelDetect* is set to *t*. In this case, no values are specified for *n_voltage* and *n_offset*.

```
evmQpsk( v("samp_out_Q"), v("samp_out_I") 1.5u, 181.81n, nil, 1.3, 0, nil)
```

Calculates the EVM value when *g_autoLevelDetect* is set to *nil*. In this case, values are specified for *n_voltage* and *n_offset*.

eyeDiagram

```
eyeDiagram(  
    o_waveform  
    n_start  
    n_stop  
    n_period  
    [ ?advOptions t_advOptions ]  
    [ ?intensityPlot g_intensityPlot ]  
)  
=> o_waveform / nil
```

Description

Returns an eye-diagram plot of the input waveform signal. It returns the waveform object of the eye-diagram plot. Using an advanced option, the function also calculates the maximum vertical and horizontal opening of the eye formed when the input waveform is folded by the specified period to form the eye.

Arguments

<i>o_waveform</i>	Input waveform signal.
<i>n_start</i>	The X-axis start value from where the eye-diagram plot is to begin.
<i>n_stop</i>	The X-axis stop value where the eye-diagram plot is to terminate.
<i>n_period</i>	The period after which the waveform is to be folded to form the eye.
<i>?advOptions t_advOptions</i>	<p>Specifies whether the vertical (Max Vertical Opening) or horizontal opening (Max Horizontal Opening) of the eye is to be calculated.</p> <p>Valid values: <code>vertical</code>, <code>horizontal</code></p> <p>Default value: <code>nil</code></p>
<i>?intensityPlot g_intensityPlot</i>	Boolean used to specify whether to generate a high intensity eye diagram plot.

Note: If *t_advOptions* is specified, the function approximates vertical eye height and horizontal eye width to assume the symmetry of the eye. The function returns the most optimum results for single-eye scenarios.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Value Returned

<code>o_waveform</code>	Returns a waveform object representing the eye-diagram plot of the input waveform
<code>nil</code>	Returns <code>nil</code> and an error message otherwise

Example

```
eyeDiagram( v("/out" ) 0n 500n 12.5n )
```

Returns a waveform that represents an eye-diagram plot.

```
eyeDiagram( v("/out" ) 0n 500n 12.5n ?advOptions "vertical" )
```

Calculates the maximum vertical opening of the eye that is formed when the input waveform is folded after 12.5n

```
eyeDiagram( v("/out" ) 0n 500n 12.5n ?advOptions "horizontal" )
```

Calculates the maximum horizontal opening of the eye that is formed when the input waveform is folded after 12.5n

eyeHeightAtXY

```
eyeHeightAtXY(  
    o_eyeDiagram  
    f_x  
    f_y  
    [ ?output t_output ]  
)  
=> f_eyeHeight / nil
```

Description

Calculates the eye height at the specified point (x,y) inside the eye diagram. Eye height is the difference of two intercepts made with the innermost traces of the eye in the y-axis direction.

Note: The specified point (x,y) must lie within the open eye whose height you want to calculate.

For more information about how the eye height is calculated, see the [eyeHeightAtXY](#) calculator function.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_eyeDiagram</code>	The eye diagram waveform that is used to calculate the eye height.
<code>f_x</code>	The x-axis value that is used to calculate the eye height.
<code>f_y</code>	The y-axis value that is used to calculate the eye height.
<code>?output t_output</code>	Specifies whether to calculate the total eye height or the eye height relative to the specified y-axis value. Possible values are: <ul style="list-style-type: none">■ <code>total</code>: (Default) Calculates the total eye height at the specified point inside the eye.■ <code>above</code>: Calculates the eye height that is above the specified y-axis value.■ <code>below</code>: Calculates the eye height that is below the specified y-axis value.

Values Returned

<code>f_eyeHeight</code>	Returns the eye height at the specified point (x,y) inside the eye diagram.
<code>nil</code>	Returns <code>nil</code> if there is an error.

Example

The following example returns the value of the total eye height at the point, $x=70p$ and $y=2.2$.

```
eyeHeightAtXY(eyeDiagram(v("/example_1" ?result "tran") 560p 5.000n 140p
?triggerPeriod 7e-11 ?autoCenter t) 70p 2.2 ?output "total")
=> 1.494594
```

The following example returns the value of the total eye height at the point, $x=40ns$, $y=500mV$.

```
eyeHeightAtXY(eyeDiagram(v("jitter" ?result "tran-tran") 200n 1.4u 2*40n
?triggerPeriod 40n ?autoCenter t) 40n 0.5 ?output "total" )
=> 838.3E-3
```

The following example returns the value of the eye height that is above $y=0.5V$ (500mV) at the point, $x=40ns$, $y=500mV$.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

```
eyeHeightAtXY(eyeDiagram(v("jitter" ?result "tran-tran") 200n 1.4u 2*40n  
?triggerPeriod 40n ?autoCenter t) 40n 0.5 ?output "above" )  
=> 439.0E-3
```

The following example returns the value of the eye height that is below $y=0.5V$ (500mV) at the point, $x=40ns$, $y=500mV$.

```
eyeHeightAtXY(eyeDiagram(v("jitter" ?result "tran-tran") 200n 1.4u 2*40n  
?triggerPeriod 40n ?autoCenter t) 40n 0.5 ?output "below" )  
=> 399.3E-3
```

eyeWidthAtXY

```
eyeWidthAtXY(  
    o_eyeDiagram  
    f_x  
    f_y  
    [ ?output t_output ]  
)  
=> f_eyeWidth / nil
```

Description

Calculates the eye width at the specified point (x,y) inside the eye diagram. Eye width is the difference of two intercepts made with the innermost traces of the eye in the x-axis direction.

Note: The specified point (x,y) must lie within the open eye whose width you want to calculate.

For more information about how the eye width is calculated, see the [eyeWidthAtXY](#) calculator function.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_eyeDiagram</code>	The eye diagram waveform that is used to calculate the eye width.
<code>f_x</code>	The x-axis value that is used to calculate the eye width.
<code>f_y</code>	The y-axis value that is used to calculate the eye width.
<code>?output t_output</code>	Specifies whether to calculate the total eye width or the eye width relative to the specified x-axis value. Possible values are: <ul style="list-style-type: none">■ <code>total</code>: (Default) Calculates the total eye width at the specified point inside the eye.■ <code>left</code>: Calculates the eye width that is left to the specified x-axis value.■ <code>right</code>: Calculates the eye width that is right to the specified x-axis value.

Values Returned

<code>f_eyeWidth</code>	Returns the eye width at the specified point (<i>x,y</i>) inside the eye diagram.
<code>nil</code>	Returns <code>nil</code> if there is an error.

Example

The following example returns the value of the total eye width at the point, *x*=70p and *y*=2 . 2.

```
eyeWidthAtXY(eyeDiagram(v("/example_1" ?result "tran") 560p 5.000n 140p
?triggerPeriod 7e-11 ?autoCenter t)^70p 2.2 ?output "total")
=> 2.388933e-11
```

The following example returns the value of the total eye width at the point, *x*=40ns, *y*=500mV.

```
eyeWidthAtXY(eyeDiagram(v("jitter" ?result "tran-tran") 200n 1.4u 2*40n
?triggerPeriod 40n ?autoCenter t) 40n 0.5 ?output "total" )
=> 36.65E-9
```

The following example returns the value of the eye width that is left to *x*=40ns at the point, *x*=40ns, *y*=500mV.

```
eyeWidthAtXY(eyeDiagram(v("jitter" ?result "tran-tran") 200n 1.4u 2*40n
?triggerPeriod 40n ?autoCenter t) 40n 0.5 ?output "left" )
=> 18.44E-9
```

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Predefined and Waveform (Calculator) Functions

The following example returns the value of the eye width that is right to $x=40\text{ns}$ at the point, $x=40\text{ns}$, $y=500\text{mV}$.

```
eyeWidthAtXY(eyeDiagram(v("jitter" ?result "tran-tran") 200n 1.4u 2*40n  
?triggerPeriod 40n ?autoCenter t) 40n 0.5 ?output "right" )  
=> 18.21E-9
```

eyeAperture

```
eyeAperture(  
    o_waveform  
    f_vref  
    f_acHeight  
    f_dcHeight  
    g_plotBox  
    ?optimize g_optimize  
)  
=> o_waveform / aperture_width / nil
```

Description

Returns the aperture of the input eye diagram signal.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Input signal, which is a eye diagram waveform for which aperture is to be calculated.
<i>f_vref</i>	Reference voltage.
<i>f_acHeight</i>	AC height, which specifies the height of the left side of the aperture window.
<i>f_dcHeight</i>	DC height, which specifies the height of the right side of the aperture window.
<i>g_plotBox</i>	Specifies whether to display the aperture in the eye diagram or calculate the eye width. Valid values: <code>t</code> or <code>nil</code> . When this argument is set to <code>t</code> , the eye aperture is displayed in the output plot. When set to <code>nil</code> , the eye aperture width is returned.
<code>?optimize g_optimize</code>	Specifies whether to calculate the reference voltage that can be used to achieve the maximum eye aperture width. Valid values: <code>t</code> or <code>nil</code> .

Values Returned

<i>o_waveform</i>	Returns the output waveform with eye aperture plotted.
<i>aperture_width</i>	Returns the aperture width.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
eyeAperture(list(eyeDiagram(v("signal" ?result "tran") 0.1n 200.0n 2.5n)  
eyeDiagram(v("signal" ?result "tran") 0.3n 200.0n 2.5n) ) 0.75 0.6 0.5 t nil )
```

This example calculates the eye aperture on the two eye diagram signals, `signal1` and `signal2`, with following values:

- `vref=0.75`
- `acHeight=0.6`
- `dcHeight=0.5`
- `plotbox=t` (to plot the eye aperture)

OCEAN Reference

Predefined and Waveform (Calculator) Functions

eyeMeasurement

```
eyeMeasurement(  
    o_waveform  
    [ ?sample n_sample ]  
    [ ?auto g_auto ]  
    [ ?horizThreshold n_horizThreshold ]  
    [ ?sample n_sample ]  
    [ ?xTypePercent0 g_xTypePercent0 ]  
    [ ?startx0 n_startx0 ]  
    [ ?starty0 n_starty0 ]  
    [ ?yTypePercent0 g_yTypePercent0 ]  
    [ ?endx0 n_endx0 ]  
    [ ?endy0 n_endy0 ]  
    [ ?xTypePercent1 g_xTypePercent1 ]  
    [ ?startx1 n_startx1 ]  
    [ ?starty1 n_starty1 ]  
    [ ?yTypePercent1 g_yTypePercent1 ]  
    [ ?endx1 n_endx1 ]  
    [ ?endy1 n_endy1 ]  
    [ ?noOfBins n_noOfBins ]  
    [ ?measure t_measure ]  
)  
=> o_waveform / nil
```

Description

Evaluates the measurements for the eye diagram plot.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_waveform</code>	The eye diagram waveform.
<code>?sample n_sample</code>	The time interval after which the signals are divided in the eye diagram plot. If this field is left blank, the data within the level 1 and level 0 regions are used to analyze the amplitude variation of the signal. This means there is some sensitivity to the actual spacing between the data points in the signal, which is caused by the variable time steps in the simulator. If the points are clustered in the curve portion, the distribution can be skewed. To perform the analysis, the sampling interval you specify in this field is divided into even time points.
<code>?auto g_auto</code>	When this argument is set to true, then the following argument values are computed automatically: <code>horizThreshold, startx0, startx1, xTypePercent0, xTypePercent1, endx0, endx1, yTypePercent0, yTypePercent1, starty0, endy0, starty1, and endy1.</code>
<code>?horizThreshold n_horizThreshold</code>	The Y-axis level (for example voltage) that represents the switching threshold of the signal, typically half the signal range. This is used to compute statistical information about the threshold.
<code>?sample n_sample</code>	The time interval after which the signals are divided in the eye diagram plot. If this field is left blank, the data within the level 1 and level 0 regions are used to analyze the amplitude variation of the signal. This means there is some sensitivity to the actual spacing between the data points in the signal, which is caused by the variable time steps in the simulator. If the points are clustered in the curve portion, the distribution can be skewed. To perform the analysis, the sampling interval you specify in this field is divided into even time points.
<code>?xTypePercent0 g_xTypePercent0</code>	Level0 X-range specified whether specified in "%". If the value is <code>t</code> , it signifies the "%" value and if the value is <code>nil</code> , it signifies the absolute value. Default value is <code>t</code> .
<code>?startx0 n_startx0</code>	Level0 X-range start value. Default value is 40.

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Predefined and Waveform (Calculator) Functions

<code>?starty0 n_starty0</code>	Level0 Y-range start value. Default value is 0.
<code>?yTypePercent0</code> <code>g_yTypePercent0</code>	Level0 Y-range specified whether specified in "%". If the value is <code>t</code> , it signifies the "%" value and if the value is <code>nil</code> , it signifies the absolute value. Default value is <code>t</code> .
<code>?endx0 n_endx0</code>	Level0 X-range end value. Default value is 60.
<code>?endy0 n_endy0</code>	Level0 Y-range end value. Default value is 50.
<code>?xTypePercent1</code> <code>g_xTypePercent1</code>	Level1 X-range specified whether specified in "%". If the value is <code>t</code> , it signifies the "%" value and if the value is <code>nil</code> , it signifies the absolute value. Default value is <code>t</code> .
<code>?startx1 n_startx1</code>	Level1 X-range start value. Default value is 40.
<code>?starty1 n_starty1</code>	Level1 Y-range start value. Default value is 50.
<code>?yTypePercent1</code> <code>g_yTypePercent1</code>	Level1 Y-range specified whether specified in "%". If the value is <code>t</code> , it signifies the "%" value and if the value is <code>nil</code> , it signifies the absolute value. Default value is <code>t</code> .
<code>?endx1 n_endx1</code>	Level1 X-range end value. Default value is 60.
<code>?endy1 n_endy1</code>	Level1 Y-range end value. Default value is 100.
<code>?noOfBins n_noOfBins</code>	Number of signal bins to be displayed in the eye diagram plot. These signals bins are used to form the horizontal (threshold crossing times) and vertical (amplitude variation) histograms.

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Predefined and Waveform (Calculator) Functions

?measure *t_measure*

Computes one of the measurement values described below:

- **level0Mean (Level0 Mean)**—Mean of the Y-values within the level0 region.
- **level0Stddev (Level0 Stddev)**—Standard deviation of the Y-values within the level0 region.
- **level1Mean (Level1 Mean)**—Mean of the Y-values within the level1 region.
- **level1Stddev (Level1 Stddev)**—Standard deviation of the Y-values within the level1 region.
- **amplitude (Eye amplitude)**—Mean to mean amplitude of the eye, computed as:
 $\text{Meanlevel1} - \text{Meanlevel0}.$
- **height (Eye height)**—Vertical opening of the eye, computed as:
 $(\text{Meanlevel1} - 3 * \text{level1}) - (\text{Meanlevel0} - 3 * \text{level0}).$
- **signalToNoise (Eye signalToNoise)**—Signal to noise ratio of the eye, computed as:
 $(\text{Meanlevel1} - \text{Meanlevel0}) / (\text{level1} + \text{level0}).$
- **thresholdCrossingStddev (Threshold crossing stddev)**—Threshold crossing standard deviation is computed only when there is a single transition region in the eye diagram because it is analyzed over the entire period.
- **thresholdCrossingAverage (Threshold crossing average)**—This is computed over the entire period.
- **width (Eye width)**—Represents the opening of the eye in the X direction. It is computed as:
 $(\text{Meantransition2} - 3 * \text{std}(\text{transition2})) - (\text{Meantransition1} - 3 * \text{std}(\text{transition1})).$

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Predefined and Waveform (Calculator) Functions

- `riseTime` (Eye Rise Time)—Two thresholds taken at the 20% and 80% points between the level0 mean and level1 mean. At each of these two thresholds, a horizontal histogram is computed, which is an analysis of the crossing points of these two thresholds, and the resulting rise time is the difference in the mean crossing point at each of these two thresholds.
- `fallTime` (Eye Fall Time)—Signal measured between the percent high and percent low of the difference between the initial and final value.
- `randJitterLeft`—Random jitter calculated from the crossing histogram of the left crossing area
- `randJitterRight`—Random jitter calculated from the crossing histogram of the right crossing area
- `determJitter`—Average deterministic jitter of the crossing areas

Value Returned

`o_waveform`

Returns the computed scalar value or a waveform for the specific measure that was passed.

`nil`

Returns `nil` and an error message otherwise.

Example

The following function computes the threshold crossing average for the eye diagram for signal /net1 from 0.0 to 2e-08 with a period of 5e-10:

```
wave_eyeDiagram=eyeDiagram(vtime('tran "/net1") 0.0 2e-08 5e-10 ?intensityPlot t)
eyeMeasurement(wave_eyeDiagram ?horizThreshold 0 ?startx0 40 ?starty0 0
?xTypePercent0 "t" ?endx0 60 ?endy0 50 ?yTypePercent0 "t" ?startx1 40 ?starty1 50
?xTypePercent1 "t" ?endx1 60 ?endy1 100 ?yTypePercent1 "t" ?noOfBins 10 ?measure
"thresholdCrossingAverage")
```

The following function is used to get the eye open width:

```
wave_eyeDiagram=eyeDiagram(vtime('tran "/net1") 0.0 2e-08 5e-10 ?intensityPlot t)
```

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Predefined and Waveform (Calculator) Functions

```
eyeMeasurement(wave_eyeDiagram ?horizThreshold 0 ?startx0 40 ?starty0 0
?xTypePercent0 "t" ?endx0 60 ?endy0 50 ?yTypePercent0 "t" ?startx1 40 ?starty1 50
?xTypePercent1 "t" ?endx1 60 ?endy1 100 ?yTypePercent1 "t" ?noOfBins 10 ?measure
"width")
```

edgeTriggeredEyeDiagram

```
edgeTriggeredEyeDiagram(  
  o_waveform  
  n_start  
  n_stop  
  o_triggerWave  
  n_threshold  
  s_edgeType  
  n_triggerOffset  
  [ ?intensityPlot g_intensityPlot ]  
)  
=> o_waveform / nil
```

Description

Returns a signal triggered at the beginning of the eye diagram instead of a fixed period.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	The eye diagram waveform.
<i>n_start</i>	The X-axis start value from where the eye diagram plot is to begin.
<i>n_stop</i>	The X-axis stop value where the eye diagram plot is to terminate.
<i>o_triggerWave</i>	The waveform that is used for triggering the eye diagram.
<i>n_threshold</i>	The Y-axis value of trigger wave at which the corresponding cross points of the trigger wave are calculated.
<i>s_edgeType</i>	Type of the crossing. Valid values: rising, falling, either.
<i>n_triggerOffset</i>	The value by which the trigger wave should be l-shifted to align with the input waveform signal.
<i>?intensityPlot g_intensityPlot</i>	Controls the intensity based plotting of the eye diagram.

Value Returned

<i>o_waveform</i>	Returns the computed scalar value or a waveform for the specific measure that was passed.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Examples

In the following example `VT("/out")` is an input waveform for which eye diagram is to be determined from `0n` to `10n`. The period to wrap or fold the eye diagram is determined by the cross points of the trigger waveform `VT("/clk")` at the given threshold.

```
edgeTriggeredEyeDiagram(VT("/out") 0n 10n VT("/clk") 2.5 "either" 0n)
```

The above function returns a waveform with the relevant edge Trigger eye diagram attributes set so that when plotted the edge trigger eye diagram is displayed.

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Predefined and Waveform (Calculator) Functions

The following example shows that an offset of `1n` signifies that `VT("/clk")` is to be l-shifted by `1n`, `lshift(VT("/clk") 1n)`, before determining the cross points. Also, intensity-based plotting is turned on.

```
edgeTriggeredEyeDiagram(VT("/out") 0n 10n VT("/clk") 2.5 "rising" 1n  
?intensityPlot t)
```


flip

```
flip(  
    o_waveform  
)  
=> o_waveform / nil
```

Description

Returns a waveform with the X vector values negated.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the input waveform mirrored about its Y axis. Returns a family of waveforms if the input argument is a family of waveforms.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot( flip( v("/net4") ) )
```

Plots the waveform for the voltage of `"/net4"` with the X vector values negated.

fourEval

```
fourEval(  
    o_waveform  
    n_from  
    n_to  
    n_by  
    [ ?baseBand g_baseBand ]  
)  
=> o_waveform / nil
```

Description

Evaluates the Fourier series represented by an expression.

This function is an inverse Fourier transformation and thus the inverse of the [dft](#) command. The `fourEval` function transforms the expression from the frequency domain to the time domain.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_from</i>	Starting point on the X axis at which to start the evaluation.
<i>n_to</i>	Increment.
<i>n_by</i>	Ending point on the X axis.
<i>?baseBand g_baseBand</i>	Accepts boolean values <code>t</code> or <code>nil</code> . The default value is <code>nil</code> . When set to <code>t</code> , the function evaluates the baseband version of the inverse of the <code>dft</code> function by converting the unsymmetrical spectrum to a symmetrical one.

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the inverse Fourier transformation of the input waveform. Returns a family of waveforms if the input argument is a family of waveforms. Returns the baseband version of the inverse of the <code>dft</code> function if <code>baseBand</code> is set to <code>t</code> .
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Example

```
plot( fourEval( v( "/net3" ) 1k 10k 10 )
```

Plots the waveform representing the inverse Fourier transformation of the voltage of `/net3` from 1k to 10k.

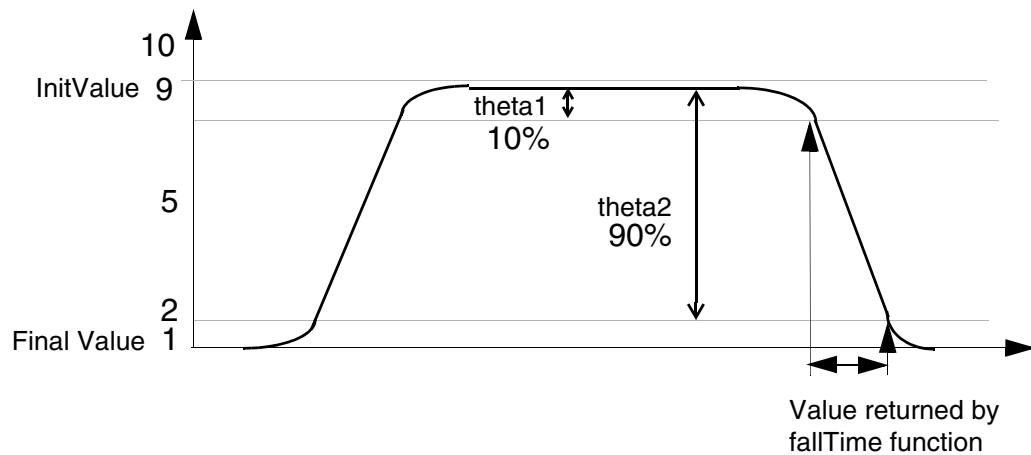
fallTime

```
fallTime(  
    o_waveform  
    n_initVal  
    g_initType  
    n_finalVal  
    g_finalType  
    n_theta1  
    n_theta2  
    [ g_multiple [ s_Xname ] [ g_histoDisplay ] [ x_noOfHistoBins ] ]  
)  
=> o_waveform / n_value / nil
```

Description

Returns the fall time measured between *theta1* (percent high) to *theta2* (percent low) of the difference between the initial value and the final value.

The *fallTime* function can also be used to compute the rise time if *initVal* is lower than *finalVal*.



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Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_initVal</i>	Initial value at which to start the computation.
<i>g_initType</i>	<p>Specifies how <i>n_initVal</i> functions.</p> <p>Valid values: a non-nil value specifies that the initial value is taken to be the value of the waveform, interpolated at <i>n_initVal</i>, and the waveform is clipped from below as follows:</p> <pre><i>o_waveform</i> = clip(<i>o_waveform</i> <i>g_initVal</i> nil)</pre> <p>where <code>nil</code> specifies that <i>n_initVal</i> is defined by the X value entered. (The command gets the Y value for the specified X value and uses that value for <i>n_initVal</i>.)</p>
<i>n_finalVal</i>	Final value at which to end the computation.
<i>g_finalType</i>	<p>Specifies how the <i>n_finalVal</i> argument functions.</p> <p>Valid values: a non-nil value specifies that the final value is taken to be the value of the waveform, interpolated at <i>n_finalVal</i>, and the waveform is clipped from above, as follows:</p> <pre><i>o_waveform</i> = clip(<i>o_waveform</i> nil <i>n_finalVal</i>)</pre> <p>where <code>nil</code> specifies that the <i>n_finalVal</i> argument is defined by the X value entered. (The command gets the Y value for the specified X value and uses that value for <i>n_finalVal</i>.)</p>
<i>n_theta1</i>	Percent high.
<i>n_theta2</i>	Percent low.
<i>g_multiple</i>	An optional boolean argument that takes the value <code>nil</code> by default. If set to <code>t</code> , the function returns multiple occurrences of the <code>fallTime</code> event.
<i>s_xName</i>	<p>An optional argument that is used only when <i>g_multiple</i> is set to <code>t</code>. It takes the value <code>time</code> by default. It controls the contents of the x vector of the waveform object returned by the function.</p> <p>Valid values: <code>'time</code>, <code>'cycle</code></p>

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Predefined and Waveform (Calculator) Functions

<i>g_histoDisplay</i>	When set to <code>t</code> , returns a waveform that represents the statistical distribution of the <code>fallTime</code> data in the form of a histogram. The height of the bars (bins) in the histogram represents the frequency of the occurrence of values within the range of <code>fallTime</code> data. Valid values: <code>t</code> <code>nil</code> Default value: <code>nil</code>
<i>x_noOfHistoBins</i>	Denotes the number of bins represented in the histogram representation. Valid values: Any positive integer Default value: <code>nil</code>

Note: *g_histoDisplay* and *x_noOfHistoBins* are added for backward compatibility only. It will be deprecated in future releases. Use the `histo` function for plotting the histogram of the resulting function.

Value Returned

<i>o_waveform</i>	Returns a waveform representing the fall time for a family of waveforms if the input argument is a family of waveforms or if <i>g_multiple</i> is set to <code>t</code> .
<i>n_value</i>	Returns a value for the fall time if the input is a single waveform.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
fallTime( v( "/net8" ) 9 nil 1 nil 10 90 )
```

Computes the fall time for the waveform representing the voltage of `"/net8"` from 9 to 1.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

freq

```
freq(  
    o_waveform  
    t_crossType  
    [ ?threshold n_threshold ]  
    [ ?mode t_mode ]  
    [ ?xName xName ]  
    [ ?histoDisplay g_histoDisplay ]  
    [ ?noOfHistoBins x_noOfHistoBins ]  
)  
=> o_outputWave / nil
```

Description

Computes the frequency of the input waveform(s) as a function of time or cycle.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_waveform</code>	Waveform, expression, or a family of waveforms.
<code>t_crossType</code>	The points at which the curves of the waveform intersect with the threshold. While intersecting, the curve may be either rising or falling. For the <code>freq</code> function, you may specify the frequency to be calculated against either the rising points or the falling points by setting <code>crossType</code> to <code>rising</code> or <code>falling</code> , respectively. The default <code>crossType</code> is <code>rising</code> .
<code>?threshold n_threshold</code>	The threshold value against which the frequency is to be calculated. This needs to be specified only when the mode selected is <code>user</code> .
<code>?mode t_mode</code>	The mode for calculating the threshold. This is <code>auto</code> , by default, in which case <code>n_threshold</code> is calculated internally. It can alternatively be set to <code>user</code> , in which case, an <code>n_threshold</code> value needs to be provided. Default Value: <code>auto</code>
<code>?xName t_xName</code>	The X-axis of the output waveform. The default value is <code>time</code> but <code>cycle</code> is also a valid value. Default Value: <code>time</code>
<code>?histoDisplay g_histoDisplay</code>	When set to <code>t</code> , returns a waveform that represents the statistical distribution of the <code>riseTime</code> data in the form of a histogram. The height of the bars (bins) in the histogram represents the frequency of the occurrence of values within the range of <code>riseTime</code> data. Valid values: <code>t nil</code> Default value: <code>nil</code>
<code>?noOfHistoBins x_noOfHistoBins</code>	Denotes the number of bins represented in the histogram representation. Valid values: Any positive integer Default value: <code>1</code>

Note: `g_histoDisplay` and `x_noOfHistoBins` are added for backward compatibility only. It will be deprecated in future releases. Use the `histo` function for plotting the histogram of the resulting function.

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Predefined and Waveform (Calculator) Functions

Value Returned

<i>o_outputWave</i>	Returns the frequency as a function of time or cycle.
<i>nil</i>	Returns <i>nil</i> if the frequency cannot be calculated.

Example

```
freq( wave1 "rising" ?mode "user" ?threshold 18.5 ?xName "cycle" )  
=> srrWave: 170938688
```

Returns the frequency for `wave1` with the `threshold` at `18.5` against `cycle` on the x-axis.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

freq_jitter

```
freq_jitter(  
    o_waveform  
    t_crossType  
    [ ?mode t_mode ]  
    [ ?threshold n_threshold ]  
    [ ?binSize n_binSize ]  
    [ ?xName t_xName ]  
    [ ?outputType t_outputType ]  
)  
=> o_waveform / f_val / nil
```

Description

Calculates the frequency jitter.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_waveform</code>	Waveform, expression, or a family of waveforms.
<code>t_crossType</code>	<p>The points at which the curves of the waveform intersect with the threshold. While intersecting, the curve may be either rising or falling.</p> <p>Valid values: <code>rising</code> and <code>falling</code>.</p> <p>Default value: <code>rising</code></p>
<code>?mode t_mode</code>	<p>The mode for calculating the threshold.</p> <p>Valid values: <code>auto</code> and <code>user</code>.</p> <p>If set to <code>user</code>, an <code>n_threshold</code> value needs to be provided.</p> <p>If set to <code>auto</code>, <code>n_threshold</code> is calculated internally.</p> <p>Default value: <code>auto</code></p>
<code>?threshold n_threshold</code>	The threshold value against which the frequency is to be calculated. It needs to be specified only when the <code>mode</code> selected is <code>user</code> .
<code>?binSize n_binSize</code>	<p>The width of the moving average window. The deviation of value at the particular point from the average of this window is the jitter.</p> <p>Default value: <code>0</code></p>
<code>?xName t_xName</code>	The X-axis of the output waveform. Valid values: <code>time</code> and <code>cycle</code> . Default value: <code>time</code>
<code>?outputType t_outputType</code>	<p>Type of output.</p> <p>Valid values: <code>sd</code> and <code>plot</code>.</p> <p>If set to <code>sd</code>, the output is a standard deviation jitter.</p> <p>If set to <code>plot</code>, the output is a waveform.</p> <p>Default value: <code>plot</code></p>

Value Returned

<code>o_waveform</code>	Returns the frequency jitter values as a function of time or cycle when the <code>outputType</code> is set to <code>plot</code> .
-------------------------	---

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Predefined and Waveform (Calculator) Functions

f_val Returns the standard deviation value when the *outputType* is set to *sd*.

nil Returns *nil* otherwise.

Example

```
freq_jitter( wave1 "rising" ?mode "user" ?threshold 1 ?binSize 2 ?xName "cycle"
?outputType "sd" )
=> 0.1338585
```

Returns the standard deviation for the frequency jitter of *wave1* with the threshold of 1 against the cycle on the x-axis.

frequency

```
frequency(  
    o_waveform  
)  
=> o_waveform / n_value / nil
```

Description

Computes the reciprocal of the average time between two successive midpoint crossings of the rising waveform.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform representing the frequency of a family of waveforms if the input argument is a family of waveforms.
<i>n_value</i>	Returns a number representing the frequency of the specified waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
frequency( v( "/net12" ) )
```

Returns the frequency of `"/net12"`.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

ga

```
ga (
    o_s11
    o_s12
    o_s21
    o_s22
    [ ?gs n_gs ]
)
=> o_waveform / nil
```

Description

Returns the available gain in terms of the supplied parameters and the optional source reflection coefficient (Gs).

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.
<i>n_gs</i>	Source reflection coefficient. Default value: 0

Value Returned

<i>o_waveform</i>	Waveform object representing the available gain.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
s11 = sp(1 1)
s12 = sp(1 2)
s21 = sp(2 1)
s22 = sp(2 2)
plot(ga(s11 s12 s21 s22))
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

gac

```
gac (  
    o_s11  
    o_s12  
    o_s21  
    o_s22  
    g_level  
    g_frequency  
)  
=> o_waveform / nil
```

Description

Computes the available gain circles.

The *g* data type on *g_level* and *g_frequency* allows either the level or the frequency to be swept while the other remains fixed.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.
<i>g_level</i>	Level in dB. It can be specified as a scalar or a vector. If it is specified as a vector, the level is swept. The <code>linRg</code> function can be called to generate a linear range. For example, <code>linRg(-30 30 5)</code> is the same as <code>list(-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30)</code> and the <i>g_level</i> argument can be specified as either of the above. In that case, an available gain circle is calculated at each one of the 13 levels.
<i>g_frequency</i>	Frequency, which can be specified as a scalar or a linear range. If it is specified as a linear range, the frequency is swept. The linear range is specified as a list with three values: the start of the range, the end of the range, and the increment. For example, <code>list(100M 1G 100M)</code> specifies a linear range with the following values: { 100M, 200M, 300M, 400M, 500M, 600M, 700M, 800M, 900M, 1G } In that case, an available gain circle is calculated at each one of the 10 frequencies.

Value Returned

<i>o_waveform</i>	Waveform object representing the available gain circles.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
s11 = sp(1 1 ?result "sp")
s12 = sp(1 2 ?result "sp")
s21 = sp(2 1 ?result "sp")
s22 = sp(2 2 ?result "sp")
plot(gac(s11 s12 s21 s22 linRg(-30 30 5) 900M))
```

gainBwProd

```
gainBwProd(  
    o_waveform  
)  
=> o_waveform / n_value / nil
```

Description

Calculates the gain-bandwidth product of a waveform representing the frequency response of interest over a sufficiently large frequency range.

Returns the product of the zero-frequency-gain and 3dB-gain-frequency.

.

$$\text{gainBwProd}(\text{gain}) = A_o * f2$$

The gain-bandwidth product is calculated as the product of the DC gain A_o and the critical frequency $f2$. The critical frequency $f2$ is the smallest frequency for which the gain equals $1/\sqrt{2}$ times the DC gain A_o .

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform representing the gain-bandwidth product for a family of waveforms if the input argument is a family of waveforms.
<i>n_value</i>	Returns a value for the gain-bandwidth product for the specified waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
gainBwProd( v( "/OUT" ) )
```

Returns the gain-bandwidth product for the waveform representing the voltage of the `" /OUT "` net.

gainMargin

```
gainMargin(  
    o_waveform  
    [ g_stable ]  
)  
=> o_waveform / n_value / nil
```

Description

Computes the gain margin of the loop gain of an amplifier.

The first argument is a waveform representing the loop gain of interest over a sufficiently large frequency range. This command returns the dB value of the waveform when its phase crosses negative pi.

```
gainMargin( gain ) = 20 * log10( value( gain f0 ) )
```

The gain margin is calculated as the magnitude of the gain in dB at f0. The frequency f0 is the lowest frequency in which the phase of the gain provided is -180 degrees. For stability, the gain margin will be negative when g_stable is set to nil. If g_stable value is set to t, then a stable design will have a positive value.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>g_stable</i>	Boolean optional value that takes the value <code>nil</code> by default.

Value Returned

<i>o_waveform</i>	Returns a waveform representing the gain margin for a family of waveforms if the input argument is a family of waveforms.
<i>n_value</i>	Returns the value for the gain margin of the specified waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
gainMargin( v( "/OUT" ) ) = -9.234  
gainMargin( v( "/OUT" ) nil ) = -9.234
```

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```
gainMargin( v( "/OUT" ) t ) = 9.234
```

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gmax

```
gmax (
    o_s11
    o_s12
    o_s21
    o_s22
)
=> o_waveform / nil
```

Description

Returns the maximum power gain in terms of the supplied parameters.

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.

Value Returned

<i>o_waveform</i>	Load reflection coefficient.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
s11 = sp(1 1)
s12 = sp(1 2)
s21 = sp(2 1)
s22 = sp(2 2)
plot(gmax(s11 s12 s21 s22))
```

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gmin

```
gmin(  
    o_Gopt  
    o_Bopt  
    f_zref  
)  
=> o_gminWave / nil
```

Description

Returns the optimum noise reflection coefficient in terms of *o_Gopt*, *o_Bopt*, and *f_zref*.

gmin is returned as follows:

```
yOpt = o_Gopt + (complex 0 1) * o_Bopt  
return (1 / f_zref(1) - yOpt) / (1 / f_zref(1) + yOpt)
```

Arguments

<i>o_Gopt</i>	Waveform object representing the optimum source conductance.
<i>o_Bopt</i>	Waveform object representing the optimum source susceptance.
<i>f_zref</i>	Reference impedance.

Value Returned

<i>o_gminWave</i>	Waveform object representing the optimum noise reflection coefficient.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
Gopt = getData("Gopt")  
Bopt = getData("Bopt")  
Zref = zref(1 ?result "sp")  
plot(gmin(Gopt Bopt Zref))
```

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Predefined and Waveform (Calculator) Functions

gmsg

```
gmsg (  
    o_s11  
    o_s12  
    o_s21  
    o_s22  
)  
=> o_waveform / nil
```

Description

Returns the maximum stable power gain in terms of the supplied parameters.

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.

Value Returned

<i>o_waveform</i>	Waveform object representing the maximum stable power gain.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
s11 = sp(1 1)  
s12 = sp(1 2)  
s21 = sp(2 1)  
s22 = sp(2 2)  
plot(gmsg(s11 s12 s21 s22))
```


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Predefined and Waveform (Calculator) Functions

gmux

```
gmux (  
    o_s11  
    o_s12  
    o_s21  
    o_s22  
)  
=> o_waveform / nil
```

Description

Returns the maximum unilateral power gain in terms of the supplied parameters.

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.

Value Returned

<i>o_waveform</i>	Waveform object representing the maximum unilateral power gain.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
s11 = sp(1 1)  
s12 = sp(1 2)  
s21 = sp(2 1)  
s22 = sp(2 2)  
plot(gmux(s11 s12 s21 s22))
```

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Predefined and Waveform (Calculator) Functions

gp

```
gp (
    o_s11
    o_s12
    o_s21
    o_s22
    [ ?gl n_gl ]
)
=> o_waveform / nil
```

Description

Computes the power gain in terms of the S-parameters.

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.
<i>n_gl</i>	Load reflection coefficient. Default value: 0

Value Returned

<i>o_waveform</i>	Waveform object representing the power gain.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
s11 = sp(1 1)
s12 = sp(1 2)
s21 = sp(2 1)
s22 = sp(2 2)
plot(gp(s11 s12 s21 s22))
```

Note: *gl* is an imaginary number which should be input in the following format:
`gp(s11 s12 s21 s22 ?gl complex(<realPart> <imagPart>))`

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Predefined and Waveform (Calculator) Functions

gpc

```
gpc (  
    o_s11  
    o_s12  
    o_s21  
    o_s22  
    g_level  
    g_frequency  
)  
=> o_waveform / nil
```

Description

Computes the power gain circles.

The *g* datatype on *g_level* and *g_frequency* allows either the level or the frequency to be swept while the other remains fixed.

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Predefined and Waveform (Calculator) Functions

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.
<i>g_level</i>	Level in dB. It can be specified as a scalar or a vector. If it is specified as a vector, the level is swept. The <code>linRg</code> function can be called to generate a linear range. For example, <code>linRg(-30 30 5)</code> is the same as <code>list(-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30)</code> and the <i>g_level</i> argument can be specified as either. In that case, a power gain circle is calculated at each one of the 13 levels.
<i>g_frequency</i>	<p>The frequency. It can be specified as a scalar or a linear range. If it is specified as a linear range, the frequency is swept. The linear range is specified as a list with three values: the start of the range, the end of the range, and the increment. For example, <code>list(100M 1G 100M)</code> specifies a linear range with the following values:</p> <p>{ 100M, 200M, 300M, 400M, 500M, 600M, 700M, 800M, 900M, 1G }</p> <p>In that case, a power gain circle is calculated at each one of the 10 frequencies.</p>

Value Returned

<i>o_waveform</i>	Waveform object representing the power gain circles.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

groupDelay

```
groupDelay(  
    o_waveform  
)  
=> o_waveform / nil
```

Description

Computes the group delay of a waveform.

This command returns the derivative of the phase of *o_waveform* / 2pi. Group delay is defined as the derivative of the phase with respect to frequency. Group delay is expressed in seconds.

It is calculated using the `vp` function as shown below:

$$\text{Group Delay} = \frac{d\phi}{d\omega} = \frac{d}{df} \left[\frac{\text{phase}(/netX)}{360} \right]$$

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform representing the group delay of the specified waveform.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot( groupDelay( v( "/net3" ) ) )
```

Plots the waveform representing the group delay of the voltage of `"/net3"`.

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gt

```
gt (
    o_s11
    o_s12
    o_s21
    o_s22
    [ ?gs n_gs ]
    [ ?gl n_gl ]
)
=> o_waveform / nil
```

Description

Returns the transducer gain in terms of the supplied parameters and the optional source reflection coefficient (Gs) and the input reflection coefficient (Gl).

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.
<i>n_gs</i>	Source reflection coefficient. Default value: 0
<i>n_gl</i>	Input reflection coefficient. Default value: 0

Value Returned

<i>o_waveform</i>	Waveform object representing the transducer gain.
<i>nil</i>	Returns <i>nil</i> and displays a message if there is an error.

Example

```
s11 = sp(1 1)
s12 = sp(1 2)
s21 = sp(2 1)
s22 = sp(2 2)
plot(gt(s11 s12 s21 s22))
```

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Note: *gl* is an imaginary number which should be input in the following format:

`gt(s11 s12 s21 s22 ?gl complex(<realPart> <imagPart>))`

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Predefined and Waveform (Calculator) Functions

harmonic

```
harmonic(  
    o_waveform  
    h_index  
)  
=> o_waveform / g_value / nil
```

Description

Returns the waveform for a given harmonic index.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>h_index</i>	The index number that designates the harmonic information to be returned. For the 'pss', 'pac, and 'pxf analyses, the index is an integer number. For the 'pdisto analysis, the index is a list of integers that correspond with the frequency names listed in the <code>funds</code> analysis parameter in the netlist. If more than one <i>h_index</i> is desired at one time, a list can be specified.

Value Returned

<i>o_waveform</i>	Returns a waveform (when a single <i>h_index</i> is specified) or family of waveforms (when more than one <i>h_index</i> is specified) if the input argument is a family of waveforms.
<i>g_value</i>	Returns the harmonic value if the input is a single waveform with the X values being harmonics
<i>nil</i>	Returns <code>nil</code> and displays a message if there is an error.

Example

For each of the following commands:

```
harmonic(v("/net49" ?result "pss-fd.pss") 1)  
harmonic(v("/Pif" ?result "pdisto-fi.pdisto") list(1 -1))
```

Each result is a complex number.

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Predefined and Waveform (Calculator) Functions

For each of the following commands:

```
harmonic(v("/net54" ?result "pac-pac") 1)
harmonic(v("/net51" ?result "sweep_pss_fd-sweep") list(8))
harmonic(v("/Pif" ?result "sweep_pac-sweep") -8)
harmonic(v("/net36" ?result "sweep_pdisto_pdisto_fi-sweep") '(1 -1))
```

Each result is a waveform.

For each of the following commands:

```
harmonic(v("/net54" ?result "pac-pac") list(1 5))
harmonic(v("/net51" ?result "sweep_pss_fd-sweep") '(1 8))
harmonic(v("/Pif" ?result "sweep_pac-sweep") list(-8 0))
harmonic(v("/net36" ?result "sweep_pdisto_pdisto_fi-sweep") '((1 -1) (2 -2) (-1 2)))
```

Each result is a family of waveforms.

Neither of the following commands should be entered:

```
harmonic(v("/net49" ?result "pss_fd.pss") list(0 1))
harmonic(v("/Pif" ?result "pdisto_fi.pdisto") '((1 -1) (-1 2)))
```

Each resulting waveform is not in a useful format.

harmonicFreqList

```
harmonicFreqList(  
    [ ?resultsDir t_resultsDir ]  
    [ ?result S_resultName ]  
)  
=> n_list / nil
```

Description

Returns a list of lists, with each sublist containing a harmonic index and the minimum and maximum frequency values that the particular harmonic ranges between.

If both of these frequency values are the same, just one frequency value is returned.

Arguments

<i>t_resultsDir</i>	Directory containing the PSF files (results). If you supply this argument, you must also supply the <i>resultName</i> argument.
<i>S_resultName</i>	Results from an analysis.

Value Returned

<i>n_list</i>	Returns a list of lists. For the 'pss', 'pac', and 'pxf' analyses, the first element of each sublist is an integer number. For the 'pdisto' analysis, the first element of each sublist is a list of integers that correspond with the frequency names listed in the <i>funds</i> analysis parameter in the netlist. For all sublists, the remaining entries are the minimum and maximum frequency values that the particular harmonic ranges between. If both of these frequency values are the same, just one frequency value is returned.
<i>nil</i>	Returns <i>nil</i> if no harmonics are found in the data.

Example

For each of the following commands:

```
harmonicFreqList( ?result "pss-fd.pss" )  
harmonicFreqList( ?result "pac-pac" )  
harmonicFreqList( ?result "sweppss_pss_fd-sweep" )
```

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```
harmonicFreqList( ?result "sweepss_pac-sweep" )
```

Each result is a list of integers.

For each of the following commands:

```
harmonicFreqList( ?result "pdisto-fi.pdisto" )  
harmonicFreqList( ?result "sweepss_pdisto_pdisto-fi-sweep" )
```

Each result is a list of lists, with each sublist containing a combination of integer numbers that correspond with the frequency names listed in the `funds` analysis parameter in the netlist. These names can also be extracted from the PSF data by using the `resultParam` function to find the `'largefundname` and `'moderatefundnames` values. For example:

```
strcat(resultParam( 'largefundname ?result "pdisto-fi.pdisto" ) " "  
resultParam( 'moderatefundnames ?result "pdisto-fi.pdisto" ))
```

Returns a string representing the order of the frequency names.

harmonicList

```
harmonicList(  
    [ ?resultsDir t_resultsDir ]  
    [ ?result S_resultName ]  
)  
=> n_list
```

Description

Returns the list of harmonic indices available in the *resultName* or current result data.

Arguments

<i>t_resultsDir</i>	Directory containing the PSF files (results). If you supply this argument, you must also supply the <i>resultName</i> argument.
<i>S_resultName</i>	Results from an analysis.

Value Returned

<i>n_list</i>	Returns a list of harmonic indices. For the 'pss', 'pac', and 'pxf' analyses, the index is an integer number. For the 'pdisto' analysis, the index is a list of integers that correspond with the frequency names listed in the 'funds' analysis parameter in the netlist.
<i>nil</i>	Returns <i>nil</i> if no harmonics are found in the data.

Example

For each of the following commands:

```
harmonicList( ?result "pss-fd.pss" )  
harmonicList( ?result "pac-pac" )  
harmonicList( ?result "sweep_pss_pss_fd-sweep" )  
harmonicList( ?result "sweep_pac-pac-sweep" )
```

Each result is a list of integers.

For each of the following commands:

```
harmonicList( ?result "pdisto-fi.pdisto" )  
harmonicList( ?result "sweep_pdisto_pdisto-fi-sweep" )
```

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Each result is a list of lists, with each sublist containing a combination of integer numbers that correspond with the frequency names listed in the 'funds analysis parameter in the netlist. These names can also be extracted from the PSF data by using the 'resultParam function to find the 'largefundname and 'moderatefundnames values. For example:

```
strcat(resultParam( 'largefundname ?result "pdisto-fi.pdisto" ) " "  
resultParam( 'moderatefundnames ?result "pdisto-fi.pdisto" ))
```

Returns a string representing the order of the frequency names.

histo

```
histo(  
    o_waveform  
    x_bins  
    n_min  
    n_max  
)  
=> o_histoWaveform / nil
```

Description

Returns a waveform that represents the statistical distribution of input data in the form of a histogram. The height of the bars (or bins) in the histogram represents the frequency of the occurrence of values within a specific period. Using the `histo` function, the range for capturing these frequencies can be specified through the `n_min` and `n_max` values.

Arguments

<code>o_waveform</code>	Input waveform.
<code>x_bins</code>	Number of bins to represent the input data.
<code>n_min</code>	The first value on the horizontal axis of the histogram. By default, it assumes the minimum value of the input waveform.
<code>n_max</code>	The last value on the horizontal axis of the histogram. By default, it assumes the maximum value of the input waveform.

Value Returned

<code>o_histoWaveform</code>	Returns a waveform representing the statistical distribution of the input waveform <code>o_waveform</code> .
<code>nil</code>	Returns <code>nil</code> in case of an error.

Example

```
histo( VT("/vin") 3 1.5 3.5)  
=> out_wave  
plot( out_wave )
```

Plots the output waveform `out_wave` as a histogram, which represents the statistical distribution of the input waveform `VT("/vin")`.

histogram2D

```
histogram2D(  
    o_waveform  
    x_nbins  
    [ t_type ]  
    [ g_setAnnotation ]  
    [ g_setDensityEstimator ]  
)  
=> o_waveform / nil
```

Description

Returns a waveform that represents the statistical distribution of input data in the form of a histogram. The height of the bars (or bins) in the histogram represents the frequency of the occurrence of values within a specific period.

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Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Input waveform.
<i>x_nbins</i>	Number of bins (bars) to be plotted in the resulting histogram plot. Valid values: 1 to 50. Default value: 10.
<i>t_type</i>	Type of histogram to be plotted. Valid values: standard, cumulative line, and cumulative box. Default value: standard.
<i>g_setAnnotation</i>	Boolean specifying whether to display the standard deviation lines in the resulting histogram plot. Valid values: t or nil Default value: nil
<i>g_setDensityEstimator</i>	Boolean specifying whether the resulting histogram plot display a curve that estimates the distribution concentration. Valid values: t or nil Default value: nil

Value Returned

<i>o_waveform</i>	Returns a waveform representing the statistical distribution of the input waveform <i>o_waveform</i> .
nil	Returns nil in case of an error.

Examples

```
histogram2D(i("/V2/PLUS" ?result "tran") 10 "standard" t t )
```

Plots the output waveform *out_wave* as a histogram, which represents the statistical distribution of the input waveform */V2/PLUS*.

iinteg

```
iinteg(  
    o_waveform  
)  
=> o_waveform / nil
```

Description

Computes the indefinite integral of a waveform with respect to the X-axis variable.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform representing the indefinite integral of the input waveform.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot( iinteg( v( "/net8" ) ) )
```

Computes the indefinite integral of the waveform representing the voltage of `"/net8"`.

imag

```
imag(  
    { o_waveform | n_input }  
)  
=> o_waveformImag / n_numberImag / nil
```

Description

Returns the imaginary part of a waveform representing a complex number or returns the imaginary part of a complex number.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_input</i>	Complex number.

Value Returned

<i>o_waveformImag</i>	Returns a waveform when the input argument is a waveform.
<i>n_numberImag</i>	Returns a number when the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
imag( v( "/net8" ) )
```

Returns a waveform representing the imaginary part of the voltage of `/net8`. You also can use the `vim` alias to perform the same command, as in

```
vim( "net8" ).
```

```
x=complex( -1 -2 ) => complex(-1, -2)
```

```
imag( x ) => -2.0
```

Creates a variable `x` representing a complex number, and returns the real portion of that complex number.

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inl

```
inl(  
    o_dacSignal  
    o_sample | o_pointList | n_interval  
    [ ?mode t_mode ]  
    [ ?threshold n_threshold ]  
    [ ?crossType t_crossType ]  
    [ ?delay f_delay ]  
    [ ?units x_units ]  
    [ ?nbsamples n_nbsamples ]  
)  
=> n_inl / nil
```

Description

Computes the integral non-linearity of a transient simple or parametric waveform.

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Predefined and Waveform (Calculator) Functions

Arguments

<code>o_dacSignal</code>	Waveform for which the integral non-linearity is to be calculated.
<code>o_sample</code>	Waveform used to obtain the points for sampling the <code>dacSignal</code> . These are the points at which the waveform crosses the threshold while either <code>rising</code> or <code>falling</code> (defined by the <code>crossType</code> argument) with the <code>delay</code> added to them.
<code>n_pointList</code>	List of domain values at which the sample points are obtained from the <code>dacSignal</code> .
<code>n_interval</code>	The sampling interval.
<code>?mode t_mode</code>	<p>The mode for calculating the threshold.</p> <p>Valid values: <code>auto</code> and <code>user</code>.</p> <p>Default value: <code>auto</code>.</p> <p>If set to <code>user</code>, an <code>n_threshold</code> value needs to be provided.</p> <p>If set to <code>auto</code>, <code>n_threshold</code> is calculated internally.</p>
<code>?threshold n_threshold</code>	The threshold value against which the integral non-linearity is to be calculated. It needs to be specified only when the <code>mode</code> is selected as <code>user</code> .
<code>?crossType t_crossType</code>	<p>The points at which the curves of the waveform intersect with the threshold. While intersecting, the curve may be either <code>rising</code> or <code>falling</code>.</p> <p>Valid values: <code>rising</code> and <code>falling</code>, respectively.</p> <p>Default <code>crossType</code> is <code>rising</code>.</p>
<code>?delay f_delay</code>	<p>The delay time after which the sampling begins.</p> <p>Valid values: Any valid time value.</p> <p>Default value: <code>0</code>.</p>
<code>?unit x_units</code>	<p>Unit for expressing the output waveform.</p> <p>Valid values: <code>abs</code> (absolute) and <code>lsb</code> (multiples of least significant bit).</p> <p>Default value: <code>abs</code>.</p>
<code>?nbsamples n_nbsamples</code>	

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Number of samples used for calculating the non-linearity. If not specified, the samples are taken against the entire data window.

Note: For each of the three ways in which the sample points can be specified, only a few of the other optional arguments are meaningful, as indicated below:

- For *o_sample*, the arguments *t_mode*, *n_threshold*, *t_crossType*, *f_delay*, and *x_units* are meaningful.
- For *n_pointList*, the arguments *x_units* are meaningful.
- For *n_interval*, the arguments *x_units*, and *n_nbsamples* are meaningful.

Value Returned

<i>n_inl</i>	Returns the integral non-linearity waveform.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
inl( wave1 wave2 ?crossType "rising" ?delay 0.4 )  
=> srrWave:175051544
```

Returns the integral non-linearity for *wave1* by taking the points at which *wave2* crosses the internally calculated threshold while *rising* as the sample points and adding a delay of 0.4 to them.

integ

```
integ(  
    o_waveform  
    [ n_initial_limit , n_final_limit ]  
)  
=> o_waveform / n_value / nil
```

Description

Computes the definite integral of the waveform with respect to a range specified on the X-axis of the waveform. The result is the value of the area under the curve over the range specified on the X-axis.

You should specify either both the limits or neither. In case you do specify the limits, they become the end points of the range on the X-axis for definite integration. If you do not specify the limits, then the range for definite integration is the entire range of the sweep on the X-axis.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>initial_limit_n</i>	Initial limit for definite integration.
<i>final_limit_n</i>	Final limit for definite integration.

Value Returned

<i>o_waveform</i>	Returns a waveform representing the definite integral for a family of waveforms if the input argument is a family of waveforms.
<i>n_value</i>	Returns a numerical value representing the definite integral of the input waveform if the input argument is a single waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
integ( v( "/out" ) )
```

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Returns the definite integral of the waveform representing the voltage of `"/out"` over its entire range.

```
integ( VT( "/out" ), 12.5n, 18n)
```

Returns the definite integral of the waveform representing the voltage of `"/out"` within a specified range.

intersect

```
intersect(  
    o_waveform1  
    o_waveform2  
)  
=> o_wave / nil
```

Description

Returns a waveform containing the points of intersection for two waveforms passed as arguments.

Arguments

<i>o_waveform1</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>o_waveform2</i>	Additional waveform object.

Value Returned

<i>o_wave</i>	Returns a waveform containing the points of intersection for the two waveforms passed as arguments.
<i>nil</i>	Returns <code>nil</code> if the two waveforms are disjoint or overlap each other, and an error message, if the arguments to the function are not correct.

Example

```
intersect( VT("/inp1") VT("/inp2") )
```


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Predefined and Waveform (Calculator) Functions

ipn

```
ipn(  
    o_spurious  
    o_reference  
    [ f_ordspur f_ordref f_epspur f_epref g_pswEEP s_measure ]  
)  
=> o_waveform / f_number / nil
```

Description

Performs an intermodulation *n*th-order intercept measurement.

The data for this measurement can be either a single input power value or a parametric input power sweep.

From each of the spurious and reference power waveforms (or points), the `ipn` function extrapolates a line of constant slope (dB/dB) according to the specified order and input power level. These lines represent constant small-signal power gain (ideal gain). The `ipn` function calculates the intersection of these two lines and returns the value of either the X coordinate (input referred) or Y coordinate.

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Predefined and Waveform (Calculator) Functions

Arguments

<i>o_spurious</i>	Waveform or number representing the spurious output power (in dBm).
<i>o_reference</i>	Waveform or number representing the reference output power (in dBm).
<i>f_ordspur</i>	Order or slope of the spurious constant-slope power line. Default value: 3
<i>f_ordref</i>	Order or slope of the reference constant-slope power line. Default value: 1
<i>f_epspur</i>	Value (in dBm) used to indicate the point where the spurious constant-slope power line begins. If <i>g_pswEEP</i> is t, this value is the input power value of the point on the <i>o_spurious</i> waveform, otherwise this value is paired with the <i>o_spurious</i> value to define the point. This point should be in the linear region of operation. (If <i>g_pswEEP</i> is t, <i>f_spspur</i> defaults to the X coordinate of the first point of the <i>o_spurious</i> wave; if <i>s_measure</i> is 'input, a number must be specified.)
<i>f_epref</i>	Value (in dBm) used to indicate the point where the reference constant-slope power line begins. If <i>g_pswEEP</i> is t, this value is the input power value of the point on the <i>o_reference</i> waveform, otherwise this value is paired with the <i>o_reference</i> value to define the point. This point should be in the linear region of operation. (If <i>g_pswEEP</i> is t, <i>f_epref</i> defaults to the X coordinate of the first point of the <i>o_reference</i> wave; if <i>s_measure</i> is 'input, a number must be specified.)
<i>g_pswEEP</i>	Boolean indicating that the input power to the circuit was a parametric sweep. The power sweep must both be in dBm and be performed at the lowest parametric level. Default value: t
<i>s_measure</i>	Name indicating if measurement is to be input referred ('input) or output referred ('output). Default value: 'input

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Predefined and Waveform (Calculator) Functions

Value Returned

<i>o_waveform</i>	Depending on setting of <i>g_pswEEP</i> and the dimension of the input waveforms, returns either a waveform or a family of waveforms.
<i>f_number</i>	If <i>o_spurious</i> and <i>o_reference</i> are numbers or they are waveforms when <i>g_pswEEP</i> is t, returns a number.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
spurWave = db20(harmonic(wave signalHarmonic))
refWave = db20(harmonic(wave referenceHarmonic))
xloc = ipn( spurWave refWave 3.0 1.0 -25 -25 )
yloc = ipn( spurWave refWave 3.0 1.0 -25 -25 t "Output")
```

Computes the IP3 point for the given wave.

Each of the following examples returns an ip3 measurement.

```
ipn(db20(harmonic(v("/Pif" ?result "pss_fd") 9))
    db20(harmonic(v("/Pif" ?result "pss_fd") 8)))

ipn(dbm(harmonic(spectralPower(v("/Pif" ?result "pss_fd")/50.0
    v("/Pif" ?result "pss_fd")) 9))
    dbm(harmonic(spectralPower(v("/Pif" ?result "pss_fd")/50.0
    v("/Pif" ?result "pss_fd")) 8)))

ipn(dbm(harmonic(spectralPower(v("/Pif" ?result "pss_fd")
    /resultParam("rif:r" ?result "pss_td")
    v("/Pif" ?result "pss_fd")) 9))
    dbm(harmonic(spectralPower(v("/Pif" ?result "pss_fd")
    /resultParam("rif:r" ?result "pss_td")
    v("/Pif" ?result "pss_fd")) 8)))

ipn(dbm(harmonic(spectralPower(i("/rif/PLUS" ?result "pss_fd")
    v("/Pif" ?result "pss_fd")) 9))
    dbm(harmonic(spectralPower(i("/rif/PLUS" ?result "pss_fd")
    v("/Pif" ?result "pss_fd")) 8))
    3. 1. -25 -25 t "Output")

ipn(dbm(harmonic(spectralPower(v("/Pif" ?result "pac")
    /resultParam("rif:r" ?result "pss_td")
    v("/Pif" ?result "pac")) -21))
    dbm(harmonic(spectralPower(v("/Pif" ?result "pac")
    /resultParam("rif:r" ?result "pss_td")
    v("/Pif" ?result "pac")) -25)))
```

ipnVRI

```
ipnVRI(  
    o_vport  
    x_harmspur  
    x_harmref  
    [ ?iport o_iport ]  
    [ ?rport f_rport ]  
    [ ?ordspur f_ordspur ]|[ ?epoint f_epoint ]  
    [ ?psweep g_pswEEP ]  
    [ ?epref f_epref ]  
    [ ?ordref f_ordref ]  
    [ ?measure s_measure ]  
)  
=> o_waveform / f_number / nil
```

Description

Performs an intermodulation *n*th-order intercept point measurement.

Use this function to simplify the declaration of an ipn measurement. This function extracts the spurious and reference harmonics from the input waveform(s), and uses `dBm(spectralPower((i or v/r),v))` to calculate the respective powers. The function passes these power curves or numbers and the remaining arguments to the `ipn` function to complete the measurement.

From each of the spurious and reference power waveforms (or points), the `ipn` function extrapolates a line of constant slope (dB/dB) according to the specified order and input power level. These lines represent constant small-signal power gain (ideal gain). The `ipn` function calculates the intersection of these two lines and returns the value of either the X coordinate (input referred) or the Y coordinate.

Arguments

<i>o_vport</i>	Voltage across the output port. This argument must be a family of spectrum waveforms (1 point per harmonic), with the option of containing a parametric input power sweep (in dBm).
<i>x_harmspur</i>	Harmonic number of the spurious voltage contained in <i>o_vport</i> . When <i>o_iport</i> is specified, also applies to a current waveform contained in <i>o_iport</i> .
<i>x_harmref</i>	Harmonic index of the reference voltage contained in <i>o_vport</i> . When <i>o_iport</i> is specified, also applies to a current waveform contained in <i>o_iport</i> .

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<code>?iport o_iport</code>	Current into the output port. This argument must be a family of spectrum waveforms (1 point per harmonic), with the option of containing a parametric input power sweep (in dBm). When specified, power is calculated using voltage and current.
<code>?rport f_rport</code>	Resistance into the output port. When specified and <code>o_iport</code> is <code>nil</code> , the output power is calculated using voltage and resistance. Default value: 50
<code>?ordspur f_ordspur</code>	Order or slope of the spurious constant-slope power line. Default value: 3
<code>?epoint f_epoint</code>	Value (in dBm) used to indicate the point where the spurious constant-slope power line begins. If <code>g_pswEEP</code> is <code>t</code> , this value is the input power value of the point on the <code>o_spurious</code> waveform, otherwise this value is paired with the <code>o_spurious</code> value to define the point. This point should be in the linear region of operation. Default value: If <code>g_pswEEP</code> is <code>t</code> , the lowest input power value; if <code>s_measure</code> is 'input', a number must be specified.
<code>?psweep g_pswEEP</code>	Boolean indicating that the input power to the circuit was a parametric sweep. The power sweep must be in dBm and must be performed at the lowest parametric level. Default value: <code>t</code>
<code>?epref f_epref</code>	Value (in dBm) used to indicate the point where the reference constant-slope power line begins. If <code>g_pswEEP</code> is <code>t</code> , this value is the input power value of the point on the <code>o_reference</code> waveform, otherwise this value is paired with the <code>o_reference</code> value to define the point. This point should be in the linear region of operation. Default value: If <code>f_epoint</code> is not <code>nil</code> , <code>f_epoint</code> ; else if <code>g_pswEEP</code> is <code>t</code> , the X coordinate of the first point of the <code>o_reference</code> wave; else if <code>s_measure</code> is 'input', a number must be specified.
<code>?ordref f_ordref</code>	Order or slope of the reference constant-slope power line. Default value: 1

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Predefined and Waveform (Calculator) Functions

`?measure`
`s_measure` Symbol indicating if measurement is to be input referred ('input) or output referred ('output).

Default value: 'input

Value Returned

`o_waveform` Depending on the setting of `g_pswEEP` and the dimension of input waveform(s), the `ipnVRI` function returns either a waveform or a family of waveforms.

`f_number` Depending on the setting of `g_pswEEP` and the dimension of input waveform(s), the `ipnVRI` function returns a number.

`nil` Returns `nil` and an error message otherwise.

Example

Each of following examples returns an ip3 measurement:

```
ipnVRI(v("/Pif" ?result "pss_fd") 9 8)
ipnVRI(v("/Pif" ?result "pss_fd") 9 8
      ?rport resultParam("rif:r" ?result "pss_td"))
ipnVRI(v("/Pif" ?result "pss_fd") 9 8
      ?iport i("/rif/PLUS" ?result "pss_fd") ?epoint -25
      ?measure "Output")
ipnVRI(v("/Pif" ?result "pac") -21 -25
      ?rport resultParam("rif:r" ?result "pss_td"))
```

ipnVRICurves

```
ipnVRICurves (
    o_vport
    x_harmspur
    x_harmref
    [ ?iport o_iport ]
    [ ?rport f_rport ]
    [ ?ordspur f_ordspur ]
    [ ?epoint f_epoint ]
    [ ?psweep g_pswEEP ]
    [ ?epref f_epref ]
    [ ?ordref f_ordref ]
    [ ?displayLabels g_displayLabels ]
)
=> o_waveform / nil
```

Description

Constructs the waveforms associated with an ipn measurement.

Use this function to simplify the creation of waves associated with an ipn measurement. This function extracts the spurious and reference harmonics from the input waveform(s), and uses `dBm(spectralPower((i or v/r),v))` to calculate the respective powers.

From each of the spurious and reference power waveforms (or points), the `ipnVRICurves` function extrapolates a line of constant slope (dB/dB) according to the specified order and input power level. These lines represent constant small-signal power gain (ideal gain). The function returns these lines and power waveforms (when present) as a family of waveforms.

This function only creates waveforms and does not perform an ipn measurement or include labels with the waveforms. Use the `ipn` or `ipnVRI` function for making measurements.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_vport</i>	Voltage across the output port. This argument must be a family of spectrum waveforms (1 point per harmonic), with the option of containing a parametric input power sweep (in dBm).
<i>x_harmspur</i>	Harmonic index of the spurious voltage contained in <i>o_vport</i> . When <i>o_iport</i> is specified, also applies to a current waveform contained in <i>o_iport</i> .
<i>x_harmref</i>	Harmonic index of the reference voltage contained in <i>o_vport</i> . When <i>o_iport</i> is specified, also applies to a current waveform contained in <i>o_iport</i> .
?iport <i>o_iport</i>	Current into the output port. This argument must be a family of spectrum waveforms (1 point per harmonic), with the option of containing a parametric input power sweep (in dBm). When specified, power is calculated using voltage and current.
?rport <i>f_rport</i>	Resistance into the output port. When specified and <i>o_iport</i> is <i>nil</i> , the output power is calculated using voltage and resistance. Default value: 50
?ordspur <i>f_ordspur</i>	Order or slope of the spurious constant-slope power line. Default value: 3
?epoint <i>f_epoint</i>	Value (in dBm) used to indicate the point where the spurious constant-slope power line begins. If <i>g_pswEEP</i> is <i>t</i> , this value is the input power value of the point on the <i>o_spurious</i> waveform, otherwise this value is paired with the <i>o_spurious</i> value to define the point. This point should be in the linear region of operation. Default value: If <i>g_pswEEP</i> is <i>t</i> , the X coordinate of the first point of the <i>o_spurious</i> wave; otherwise a number must be specified.
?psweep <i>g_pswEEP</i>	Boolean indicating that the input power to the circuit was a parametric sweep. The power sweep must be in dBm and must be performed at the lowest parametric level. Default value: <i>t</i>

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Predefined and Waveform (Calculator) Functions

<code>?epref <i>f_epref</i></code>	<p>Value (in dBm) used to indicate the point where the reference constant-slope power line begins. If <i>g_pswEEP</i> is <code>t</code>, this value is the input power value of the point on the <i>o_reference</i> waveform, otherwise this value is paired with the <i>o_reference</i> value to define the point. This point should be in the linear region of operation.</p> <p>Default value: If <i>f_epoint</i> is not <code>nil</code>, <i>f_epoint</i>; else if <i>g_pswEEP</i> is <code>t</code>, the X coordinate of the first point of the <i>o_reference</i> wave; else a number must be specified.</p>
<code>?ordref <i>f_ordref</i></code>	<p>Order or slope of the reference constant-slope power line.</p> <p>Default value: 1</p>
<code>?displayLabels <i>g_displayLabels</i></code>	<p>Specifies whether to display labels on the plot.</p> <p>Valid values:</p> <ul style="list-style-type: none">■ <code>t</code>: Labels are displayed on the plot.■ <code>nil</code>: Labels are not displayed on the plot. <p>Default value: <code>t</code></p>

Value Returned

<code><i>o_waveform</i></code>	A family of waveforms that contains the spurious and reference tangent lines, and when <i>g_pswEEP</i> is <code>t</code> , contains the spurious and reference waveforms.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

Each of following examples returns curves related to an ip3 measurement:

```
ipnVRIcurves(v("/Pif" ?result "pss_fd") 9 8)
ipnVRIcurves(v("/Pif" ?result "pss_fd") 9 8
  ?rport resultParam("rif:r" ?result "pss_td"))
ipnVRIcurves(v("/Pif" ?result "pss_fd") 9 8
  ?iport i("/rif/PLUS" ?result "pss_fd") ?epoint -25)
ipnVRIcurves(v("/Pif" ?result "pac") -21 -25
  ?rport resultParam("rif:r" ?result "pss_td"))
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

kf

```
kf (
    o_s11
    o_s12
    o_s21
    o_s22
)
=> o_waveform / nil
```

Description

Returns the stability factor in terms of the supplied parameters.

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.

Value Returned

<i>o_waveform</i>	Waveform object representing the stability factor.
<i>nil</i>	Returns <i>nil</i> if there is an error.

Example

```
s11 = sp(1 1)
s12 = sp(1 2)
s21 = sp(2 1)
s22 = sp(2 2)
plot(kf(s11 s12 s21 s22))
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

In

```
ln(  
  { o_waveform | n_number }  
)  
=> o_waveform / f_number / nil
```

Description

Gets the base-e (natural) logarithm of a waveform or number.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the base-e (natural) logarithm of the input waveform if the input argument is a waveform object, or returns a family of waveforms if the input argument is a family of waveforms
<i>f_number</i>	Returns a number if the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
ln( v( "/net9" ) )
```

Gets a waveform that is calculated as the natural logarithm of the input waveform.

```
ln(ymax(v("/net9")))
```

Gets a waveform that is calculated as the natural logarithm of the following: `ymax(v("/net9"))`.

```
ln(100)  
=> 4.60517
```

Gets the natural logarithm of 100.

log10

```
log10(  
    { o_waveform | n_number }  
)  
=> o_waveform / n_number / nil
```

Description

Gets the base-10 logarithm of a waveform or a number.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform object if the input argument is a waveform object or returns a family of waveforms if the input argument is a family of waveforms.
<i>n_number</i>	Returns a number that is calculated as the base-10 logarithm of the input number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
log10( v( "/net9" ) )
```

Gets a waveform that is calculated as the base-10 logarithm of the input waveform.

```
log10( ymax( v( "/net9" ) ) )
```

Gets a waveform representing the base-10 logarithm of `ymax(v("/net9"))`.

```
log10( 100 )  
=> 2.0
```

Gets the base-10 logarithm of 100, or 2.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

lsb

```
lsb(  
    o_s11  
    o_s12  
    o_s21  
    o_s22  
    g_frequency  
)  
=> o_waveform / nil
```

Description

Computes the load stability circles.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.
<i>g_frequency</i>	<p>Frequency. It can be specified as a scalar or a linear range. If it is specified as a linear range, the frequency is swept. The linear range is specified as a list with three values: the start of the range, the end of the range, and the increment. For example, <code>list(100M 1G 100M)</code> specifies a linear range with the following values:</p> <pre>{ 100M, 200M, 300M, 400M, 500M, 600M, 700M, 800M, 900M, 1G }</pre> <p>In that case, a load stability circle is calculated at each one of the 10 frequencies</p>

Value Returned

<i>o_waveform</i>	Waveform object representing the load stability circles.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot(lsb(s11 s12 s21 s22 list(800M 1G 100M)))
```

lshift

```
lshift(  
    o_waveform  
    n_delta  
)  
=> o_waveform / nil
```

Description

Shifts the waveform to the left by the delta value.

This command is the inverse of the rshift command.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_delta</i>	Value by which the waveform is to be shifted.

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the input waveform shifted to the left. Returns a family of waveforms if the input argument is a family of waveforms.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot( lshift( v( "/net8" ) 30u ) )
```

Shifts the waveform representing the voltage of `"/net8"` to the left by `30u` and plots the resulting waveform.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

mag

```
mag (
    { o_waveform | n_number }
)
=> o_waveform / n_number / nil
```

Description

Gets the magnitude of a waveform or number.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform object if the input argument is a waveform object or returns a family of waveforms if the input argument is a family of waveforms.
<i>n_number</i>	Returns a number if the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
mag( v( "5" ) )
```

Gets the magnitude of the waveform representing the voltage at net 5. You can also use the `vm` alias to perform the same command, as in `vm("5")`.

```
mag( i( "VFB" ) )
```

Gets the magnitude of the waveform representing current through the `VFB` component. You can also use the `im` alias to perform the same command, as in `im("VFB")`.

```
mag( -10 ) => 10
```

Returns the magnitude of `-10`.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

nc

```
nc (  
    o_Fmin  
    o_Gmin  
    o_rn  
    g_level  
    g_frequency  
)  
=> o_waveform / nil
```

Description

Computes the noise circles.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_Fmin</i>	Waveform object representing the minimum noise factor.
<i>o_Gmin</i>	Waveform object representing the optimum noise reflection.
<i>o_rn</i>	Waveform object representing the normalized equivalent noise resistance.
<i>g_level</i>	Level in dB. It can be specified as a scalar or a vector. The level is swept, if it is specified as a vector. The <code>linRg</code> function can be called to generate a linear range. For example, <code>linRg(-30 30 5)</code> is the same as <code>list(-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30)</code> and the <i>g_level</i> argument can be specified as either of the above. In that case, a noise circle is calculated at each one of the 13 levels.
<i>g_frequency</i>	Frequency. It can be specified as a scalar or a linear range. The frequency is swept if it is specified as a linear range. The linear range is specified as a list with three values: the start of the range, the end of the range, and the increment. For example, <code>list(100M 1G 100M)</code> specifies a linear range with the following values: {100M, 200M, 300M, 400M, 500M, 600M, 700M, 800M, 900M, 1G } In that case, a noise circle is calculated at each one of the 10 frequencies.

Value Returned

<i>o_waveform</i>	Waveform object representing the noise circles.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
Gopt = getData("Gopt")
Bopt = getData("Bopt")
Zref = zref(1 ?result "sp")
Gmin = gmin(Gopt Bopt Zref)
Fmin = getData("Fmin")
rn = getData("NNR")
NC = nc(Fmin Gmin rn 10 list(100M 1G 100M))
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

```
displayMode("smith")  
smithType("impedance")  
plot(NC)
```

normalQQ

```
normalQQ(  
    o_waveform  
)  
=> o_waveform / nil
```

Description

Returns a quantile-quantile plot of the sample quantiles versus theoretical quantiles from a normal distribution. If the distribution is normal, the plot is close to a linear waveform.

Argument

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Values Returned

<i>o_waveform</i>	Returns the waveform representing the normal quantile plot.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
normalQQ(v("net10" ?result "tran"))
```

Returns the quantile plot for the `v("net10" ?result "tran")` signal.

overshoot

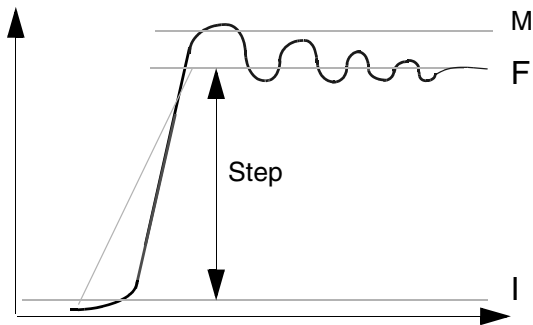
```
overshoot (
    o_waveform
    n_initVal
    g_initType
    n_finalVal
    g_finalType
    [ g_multiple [ s_Xname ] ]
    [ g_histoDisplay ]
    [ x_noOfHistoBins ]
)
=> o_waveform / n_value /nil
```

Description

Computes the percentage by which an expression overshoots a step going from the initial value to the final value you enter.

This command returns the overshoot of *o_waveform* as a percentage of the difference between the initial value and the final value.

In the equation below, M represents Maximum Value of the peak wave, F represents Final Value of the settled wave, and I represents Initial Value of the wave.



$$\text{Overshoot} = \frac{(M - F) \times 100}{F - I}$$

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Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_initVal</i>	Initial X value at which to start the computation.
<i>g_initType</i>	<p>Specifies how <i>initVal</i> functions.</p> <p>Valid values: a non-nil value specifies that the initial value is taken to be the value of the waveform, interpolated at <i>initVal</i>, and the waveform is clipped from below, as follows:</p> <pre><i>o_waveform</i> = clip(<i>o_waveform</i> <i>initVal</i> nil)</pre> <p><i>nil</i> specifies that <i>initVal</i> is defined by the X value entered. (The command gets the Y value for the specified X value and uses that value for <i>initVal</i>.)</p>
<i>n_finalVal</i>	Final value at which to end the computation.
<i>g_finalType</i>	<p>Specifies how <i>finalVal</i> functions.</p> <p>Valid values: a non-nil value specifies that the final value is taken to be the value of the waveform, interpolated at <i>finalVal</i>, and the waveform is clipped from above, as follows:</p> <pre><i>o_waveform</i> = clip(<i>o_waveform</i> nil <i>finalVal</i>)</pre> <p><i>nil</i> specifies that <i>finalVal</i> is defined by the X value entered. (The command gets the Y value for the specified X value and uses that value for <i>finalVal</i>.)</p>
<i>g_multiple</i>	An optional boolean argument that takes the value <code>nil</code> by default. If set to <code>t</code> , the function returns multiple occurrences of the overshoot event.
<i>s_xName</i>	<p>An optional argument that is used only when <i>g_multiple</i> is set to <code>t</code>. It takes the value <code>time</code> by default. It controls the contents of the x vector of the waveform object returned by the function.</p> <p>Valid values: <code>'time</code>, <code>'cycle</code></p>

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Predefined and Waveform (Calculator) Functions

<i>g_histoDisplay</i>	When set to <i>t</i> , returns a waveform that represents the statistical distribution of the <i>riseTime</i> data in the form of a histogram. The height of the bars (bins) in the histogram represents the frequency of the occurrence of values within the range of <i>riseTime</i> data. Valid values: <i>t</i> <i>nil</i> Default value: <i>nil</i>
<i>x_noOfHistoBins</i>	Denotes the number of bins represented in the histogram representation. Valid values: Any positive integer Default value: <i>nil</i>

Note: *g_histoDisplay* and *x_noOfHistoBins* are added for backward compatibility only. It will be deprecated in future releases. Use the *histo* function for plotting the histogram of the resulting function.

Value Returned

<i>o_waveform</i>	Returns a waveform (or family of waveforms) representing the amount of overshoot in comparison to the whole signal if the input argument is a family of waveforms or if <i>g_multiple</i> is set to <i>t</i> .
<i>n_value</i>	Returns a value for the amount of overshoot in comparison to the whole signal if the input is a single waveform.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
overshoot( v( "/net8" ) 7n t 3.99u t )
```

Returns the value of the overshoot for the waveform representing the voltage of *"/net8"*.

```
overshoot(VT("/out") 0.5 nil 4.95 nil 5 t 'time)
```

Returns multiple occurrences of overshoot specified against time-points at which each overshoot event occurs.

```
overshoot(VT("/out") 0.5 nil 4.95 nil 5 t 'cycle)
```

Returns multiple occurrences of overshoot specified against cycle numbers, where a cycle number refers to the *n*'th occurrence of the overshoot event in the input waveform.

pavg

```
pavg(  
    o_waveform  
    n_from  
    n_to  
    [ n_period [ n_sfactor ] ]  
)  
=> o_waveform / nil
```

Description

Computes the periodic average of a family of signals for each time point.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like srrWave:XXXXX.).
<i>n_from</i>	Starting numeric value for the range on the X-axis.
<i>n_to</i>	Ending numeric value for the range on the X-axis.
<i>n_period</i>	Numeric value for the period of the input waveform.
<i>n_sfactor</i>	Sampling factor. This can be increased in order to increase the accuracy of the output. Default value: 1

Values Returned

<i>o_waveform</i>	Returns a waveform representing the periodic average of a family of signals.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
pavg( v("/net8") ?from 1n ?to 20n ?period 2n ?sfactor 1)
```

Returns the value of the periodic average for the family of waveforms representing the voltage of "/net8".

peak

```
peak(  
    o_waveform  
    [ ?from f_from ]  
    [ ?to f_to ]  
    [ ?xtol f_xtol ]  
    [ ?ytol f_ytol ]  
    [ ?withLast g_withLast ]  
  
    )  
=> o_waveform / nil
```

Description

Detects the peaks in the input waveform and returns the X and Y coordinates of these peak points in the form of a waveform.

Note: The function will not work for waveforms that comprise of complex numbers.

Arguments

<code>o_waveform</code>	Input waveform.
<code>?from f_from</code>	The initial point on the given waveform to start determining the peaks. By default, the first point of the waveform is the starting point.
<code>?to f_to</code>	The final point on the given waveform up to which the peaks are to be determined. By default, the last point of the waveform is the end point.
<code>?xtol f_xtol</code>	The distance on the X axis within which all peaks are to be filtered.Default: 0.0
<code>?ytol f_ytol</code>	The distance on the Y axis within which all peaks are to be filtered.Default: 0.0
<code>?withLast g_withLast</code>	Determines whether to include the last point in the peak calculation or not. When this argument is set to <code>t</code> , the last point is included in the plot if it is a higher than the previous point. When set to <code>nil</code> , the plot stops at the last peak.

Note: If both `f_xtol` and `f_ytol` are specified, the filtering mechanism will operate as follows:

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Predefined and Waveform (Calculator) Functions

- The maximum peak is selected first.
- All adjacent peaks in the neighborhood of both f_{xtol} in the X-axis direction and f_{ytol} in the Y-axis direction are then filtered.
- Next, all the peaks in the rectangular window thus formed are filtered based on both f_{xtol} and f_{ytol} .

If only one of f_{xtol} or f_{ytol} is specified, the peaks are filtered only in either the X-axis direction or the Y-axis direction, respectively.

Value Returned

<code>o_waveform</code>	Returns a waveform whose X and Y coordinates of the peaks are determined from the input waveform and the peaks are filtered based on the f_{xtol} and f_{ytol} criteria.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
peak( vt("/out") ?from 1n ?to 20n ?xtol 2n ?ytol 0.5)
```

Out of all the peaks in the region starting from 1n to 20n, the function returns a waveform comprising of some of these peaks that satisfy the criteria of $x-tol$ (2n) and $ytol$ (0.5).

peakToPeak

```
peakToPeak(  
    o_waveform  
    [ ?overall type_overall ]  
)  
=> o_waveform / n_value / nil
```

Description

Returns the difference between the maximum and minimum values of a waveform.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>?overall overall</i>	

Value Returned

<i>o_waveform</i>	Returns a waveform or a family of waveforms if the input argument is a family of waveforms.
<i>n_value</i>	Returns the difference between the maximum and minimum values of a waveform if the input argument is a single waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
peakToPeak( v( "/net2" ) )
```

Returns the difference between the maximum and minimum values of the waveform representing the voltage of the `/net2` net.

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Predefined and Waveform (Calculator) Functions

period_jitter

```
period_jitter(  
    o_waveform  
    t_crossType  
    [ ?mode t_mode ]  
    [ ?threshold n_threshold ]  
    [ ?binSize n_binSize ]  
    [ ?xName t_xName ]  
    [ ?outputType t_outputType ]  
)  
=> o_waveform / f_val / nil
```

Description

Computes the period jitter. It returns a waveform or a value representing deviation from the average period.

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Predefined and Waveform (Calculator) Functions

Arguments

<code>o_waveform</code>	Name of the signal, expression, or a family of waveforms.
<code>t_crossType</code>	<p>The points at which the curves of the waveform intersect with the threshold. While intersecting, the curve may be either rising or falling.</p> <p>Valid values: <code>rising</code> and <code>falling</code>.</p> <p>Default value: <code>rising</code>.</p>
<code>?mode t_mode</code>	<p>The mode for calculating the threshold. Valid values: <code>auto</code> and <code>user</code>.</p> <p>If set to <code>user</code>, an <code>n_threshold</code> value needs to be specified by you.</p> <p>If set to <code>auto</code>, <code>n_threshold</code> is calculated as:</p> <p>Auto Threshold Value = integral of the waveform divided by the X range</p> <p>Default value: <code>auto</code></p>
<code>?threshold n_threshold</code>	The threshold value against which the period is to be calculated. It needs to be specified only when the mode selected is <code>user</code> .
<code>?binSize n_binSize</code>	<p>The width of the moving average window. The deviation of value at the particular point from the average of this window is the jitter.</p> <p>If <code>binSize=0</code>, all periods are used to calculate the average.</p> <p>If <code>binSize=N</code>, the last N periods are used to calculate the average.</p> <p>Default value: 0</p>
<code>?xName t_xName</code>	<p>The X-axis of the output waveform. It specifies whether you want to retrieve the period jitter against time (or another X-axis parameter for non-transient data) or cycle. Cycle numbers refer to the n'th occurrence of the delay event in the input waveform.</p> <p>Valid values: <code>time</code> and <code>cycle</code>.</p> <p>Default value: <code>time</code></p>

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Predefined and Waveform (Calculator) Functions

`?outputType` *t_outputType* Type of output. Valid values: `sd` and `plot`.
If set to `plot`, the output is a jitter waveform.
If set to `sd`, the output is a standard deviation of the jitter waveform.
Default value: `plot`

Value Returned

o_waveform Returns the period jitter values as a function of time or cycle when the *outputType* is set to `plot`.
f_val Returns the standard deviation value when the *outputType* is set to `sd`.
`nil` Returns `nil` otherwise.

Example

```
period_jitter( wave1 "rising" ?mode "user" ?threshold 1 ?binSize 2 ?xName "cycle"
?outputType "sd" )
=> 1.695467
```

Returns the standard deviation for the period jitter of `wave1` with the threshold of 1 against the cycle on the x-axis.

phase

```
phase(  
    { o_waveform | n_number }  
)  
=> o_waveform / n_number / nil
```

Description

Gets the phase of the waveform or number. The `phase` command is similar to the `phaseDegUnwrapped` command and returns the unwrapped phase in degrees.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform object if the input argument is a waveform object or returns a family of waveforms if the input argument is a family of waveforms.
<i>n_number</i>	Returns a number if the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
phase( v( "5" ) )
```

Gets the phase of the waveform representing the voltage at net 5. You can also use the `vp` alias to perform the same command, as in `vp("5")`.

```
phase( i( "VFB" ) )
```

Gets the phase of the waveform representing the current through the `VFB` component. You can also use the `ip` alias to perform the same command, as in `ip("VFB")`.

```
phase( -2.0 ) => 180.0
```

Gets the phase of `-2`.

phaseDeg

```
phaseDeg(  
    { o_waveform | n_number }  
)  
=> o_waveform / n_number / nil
```

Description

Calculates the wrapped phase in degrees of a waveform and returns a waveform.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the wrapped phase in degrees of the input waveform. Returns a family of waveforms if the input argument is a family of waveforms.
<i>n_number</i>	Returns a number if the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
phaseDeg( v( "vout" ) )
```

Takes the input waveform, representing the voltage of the "vout" net, and returns the waveform object representing the wrapped phase in degrees.

phaseDegUnwrapped

```
phaseDegUnwrapped(  
    { o_waveform | n_number }  
)  
=> o_waveform / n_number / nil
```

Description

Calculates the unwrapped phase in degrees of a waveform and returns a waveform.

The `phaseDegUnwrapped` function shifts the phase by $\pm 2\pi$ when the difference in phases of two consecutive points is greater than π radians.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform object representing the unwrapped phase in degrees of the input waveform. Returns a family of waveforms if the input argument is a family of waveforms.
<i>n_number</i>	Returns a number if the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
phaseDegUnwrapped( v( "vout" ) )
```

Takes the input waveform, representing the voltage of the "vout" net, and returns the waveform object representing the unwrapped phase in degrees.

phaseDegUnwrappedWithFreq

```
phaseDegUnwrappedWithFreq(  
    o_waveform  
    g_frequency  
)  
=> o_waveform / nil
```

Description

Calculates the unwrapped phase in degrees of a waveform and returns a waveform with the specified start frequency, the phase of which remains in the range of -180 to 180 degrees.

Note that if the phase increases with frequency, the waveform does not start from +180 because otherwise the rest of the waveform will be out of the range. Similarly, if the phase decreases with frequency, the waveform does not start from -180.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>g_frequency</i>	Starting frequency.

Value Returned

<i>o_waveform</i>	Returns a waveform object, representing the unwrapped phase in degrees.
<i>nil</i>	Returns <code>nil</code> if there is an error.

Examples

The following function returns a waveform object representing the unwrapped phase in degrees.

```
openResults("./simulation/loopfinder/opAmp_tb/maestro/results/maestro/  
Interactive.3/psf/loopfinder_opAmp_tb_1/psf")  
;Opens the simulation results stored in the specified results directory.  
results()  
;Lists the available results in the specified directory.  
selectResult('stb')
```

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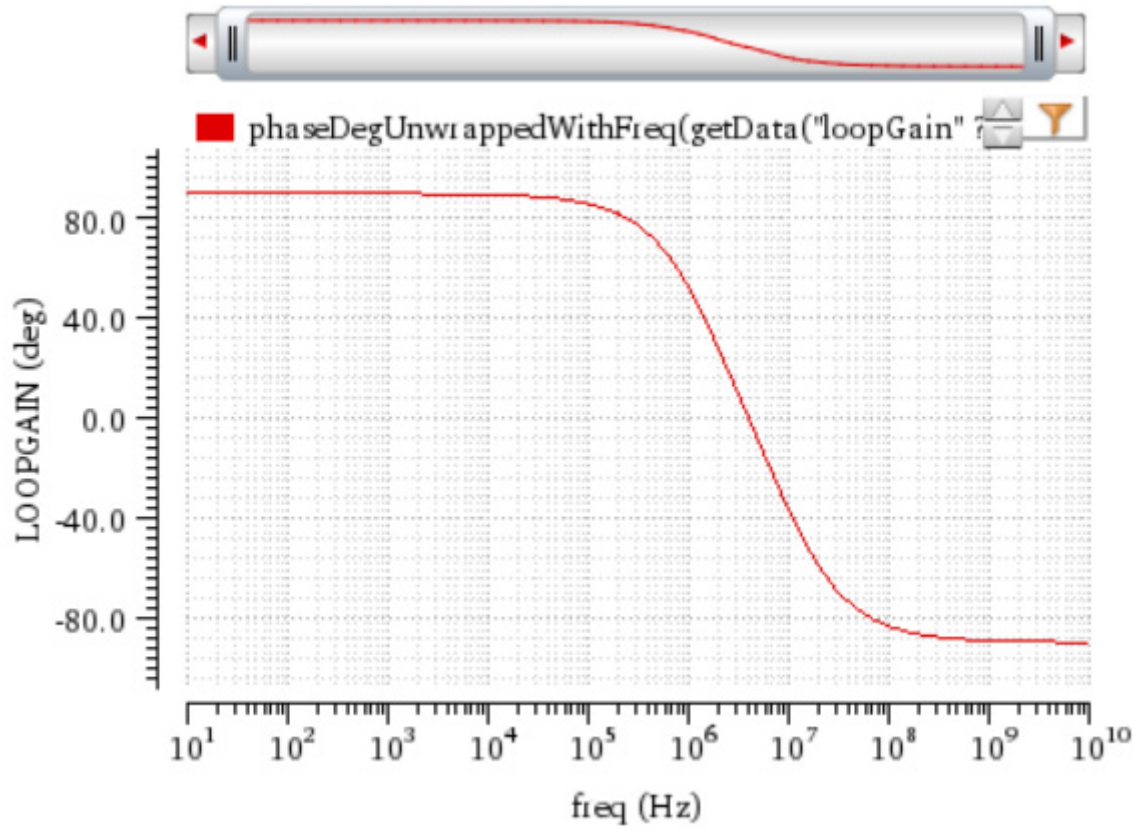
Predefined and Waveform (Calculator) Functions

```
;Selects the specified result.
outputs()
;List the available outputs in the selected result.
w=getData("loopGain" ?result "stb")
;Creates the waveform object 'w' for the output 'loopGain' of the result 'stb'.
phaseDegUnwrappedWithFreq(w 10G)
;Creates a waveform object representing the unwrapped phase in degrees of the
specified waveform 'w' for the specified start frequency, the phase of which is in
the range of -180 to 180 degrees.
plot(phaseDegUnwrappedWithFreq(waveform 10G))
;Plots the waveform object in the Waveform window.
=> "./simulation/loopfinder/opAmp_tb/maestro/results/maestro/Interactive.3/psf/
loopfinder_opAmp_tb_1/psf"
=>
(pz stb stb_margin tran tranOp
  lf model instance output designParamVals
  primitives subckts variables
)
=>
stdobj@0x36c9f2f0
=>
("loopGain")
=>
srrWave:0x3894e260
=>
srrWave:0x3894e270
=>
rdbLoadResults("fnxSession0" "./simulation/loopfinder/opAmp_tb/maestro/results/
maestro/Interactive.3/psf/loopfinder_opAmp_tb_1/psf")
=>t
```

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Predefined and Waveform (Calculator) Functions

=>t



phaseMargin

```
phaseMargin(  
    o_waveform  
)  
=> o_waveform / n_value / nil
```

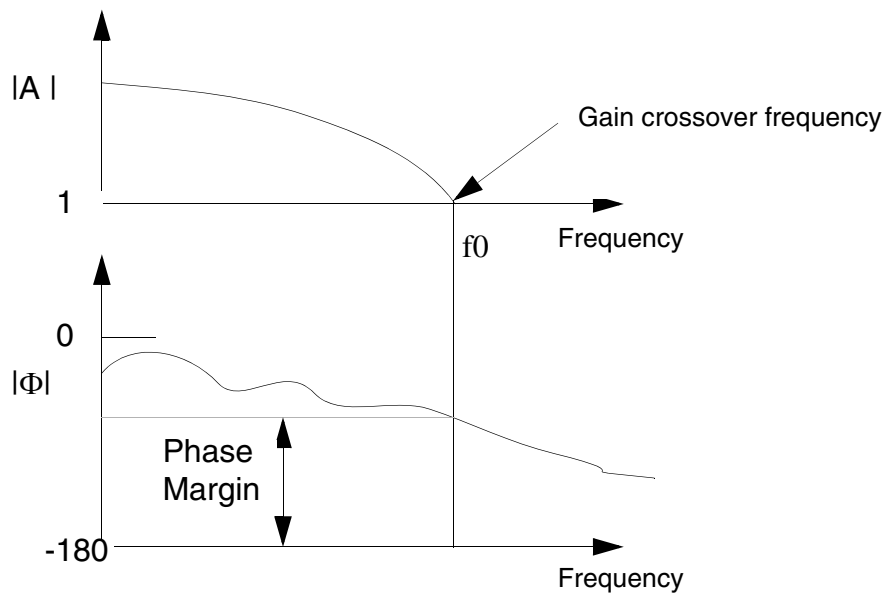
Description

Computes the phase margin of the loop gain of an amplifier.

You supply a waveform representing the loop gain of interest over a sufficiently large frequency range.

$\text{phaseMargin}(\text{gain}) = 180 + \text{phase}(\text{value}(\text{gain } f_0))$

The phase margin is calculated as the difference between the phase of the gain in degrees at f_0 and at -180 degrees. The frequency f_0 is the lowest frequency where the gain is 1. For stability, the phase margin must be positive.



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Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform representing the phase margin of the loop gain of an amplifier for a family of waveforms if the input argument is a family of waveforms.
<i>n_value</i>	Returns the value (in degrees) equivalent to the phase margin of the input waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
phaseMargin( v( "/OUT" ) )
```

Returns the phase margin for the waveform representing the voltage of the `"/OUT"` net.

phaseRad

```
phaseRad(  
    { o_waveform | n_number }  
)  
=> o_waveform / n_number / nil
```

Description

Calculates the wrapped (discontinuous) phase in radians of a waveform.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_number</i>	Number.

Value Returned

<i>o_waveform</i>	Returns a waveform representing a discontinuous value (in radians) for the phase of the input waveform. Returns a family of waveforms if the input argument is a family of waveforms.
<i>n_number</i>	Returns a number when the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot( phaseRad( v( "/OUT" ) ) )
```

Returns the wrapped phase of the waveform representing the voltage of the `" /OUT"` net.

phaseRadUnwrapped

```
phaseRadUnwrapped(  
    o_waveform  
)  
=> o_waveform / nil
```

Description

Calculates the unwrapped (continuous) phase in radians of a waveform and returns a waveform.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform representing the unwrapped (continuous) value for the phase of the input waveform in radians. Returns a family of waveforms if the input argument is a family of waveforms.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot( phaseRadUnwrapped( v( "/OUT" ) )
```

Returns the unwrapped phase of the waveform representing the voltage of the `"/OUT"` net.

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Predefined and Waveform (Calculator) Functions

PN

```
PN (
    o_waveform
    t_crossType
    n_threshold 1.0
    [ ?windowName t_windowName ]
    [ ?smooth x_smooth ]
    [ ?windowSize x_windowSize ]
    [ ?detrending t_detrending ]
    [ ?cohGain f_cohGain ]
)
=> o_waveform / nil
```

Description

Calculates the transient phase noise of the input waveforms in decibels (dB_C/Hz). Phase noise is defined as the power spectral density of the absolute jitter of an input waveform.

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Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>?crossType t_crossType</i>	<p>The points at which the curves of the waveform intersect with the threshold. While intersecting, the curve may be either rising or falling.</p> <p>Valid values: <code>rising</code> and <code>falling</code>, respectively.</p> <p>Default <code>crossType</code> is <code>rising</code>.</p>
<i>?windowName t_windowName</i>	<p>The window type. Valid values: <code>'Blackman'</code>, <code>'Cosine2'</code>, <code>'Cosine4'</code>, <code>'ExtCosBell'</code>, <code>'HalfCycleSine'</code>, <code>'HalfCycleSine3'</code> or <code>'HalfCycleSine6'</code>, <code>'Hamming'</code>, <code>'Hanning'</code>, <code>'Kaiser'</code>, <code>'Parzen'</code>, <code>'Rectangular'</code>, <code>'Triangular'</code>, or <code>'Nuttall'</code>.</p> <p>Default value: <code>'Rectangular'</code></p>
<i>?smooth x_smooth</i>	<p>The Kaiser window smoothing parameter. The 0 value requests no smoothing. Valid values: <code>0 <= x_smooth <= 15</code>.</p> <p>Default value: 1</p>
<i>?windowSize x_windowSize</i>	<p>The number of frequency domain points to use in the Fourier analysis. A larger window size results in an expectation operation over fewer samples, which leads to larger variations in the power spectral density. A small window size can smear out sharp steps in the power spectral density that might really be present.</p> <p>Default value: 256</p>
<i>?detrending t_detrending</i>	<p>The detrending mode to use. Valid values: <code>'None'</code>, <code>'mean'</code>, <code>'Linear'</code></p> <p>Default value: <code>'Mean'</code></p>
<i>?cohGain f_cohGain</i>	

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Predefined and Waveform (Calculator) Functions

A scaling parameter. A non-zero value scales the power spectral density by $1/(f_cohGain)$. Valid values: *none*, *default*, *magnitude*, *dB20*, or *dB10*

Default value: `db20`

Value Returned

<code>o_waveform</code>	The power spectral density waveform returned when the command is successful.
<code>nil</code>	Returns <code>nil</code> when the command fails.

Example

```
PN(v("net9") "rising" 1.0 ?windowName "Rectangular" ?smooth 1 ?windowSize 256  
?detrending "Mean" ?cohGain (10**(/20)) )
```

Returns the Phase Noise waveform, `net9`, for the window type `rectangular` at threshold value `1.0`.

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Predefined and Waveform (Calculator) Functions

pow

```
pow(  
  { o_waveformBase | n_numberBas }  
  { o_waveformExpn | n_numberExpn }  
)  
=> o_waveform / n_result / nil
```

Description

Takes the exponent of a given waveform or number.

Arguments

<i>o_waveformBase</i>	Waveform object to be used as the base for the expression.
<i>o_waveformExpn</i>	Waveform object to be used as the exponent for the expression.
<i>n_numberBase</i>	Number to be used as the base for the expression.
<i>n_numberExpn</i>	Number to used as the exponent for the expression.

Value Returned

<i>o_waveform</i>	Returns a family of waveforms if one of the input arguments is a family of waveforms or returns a waveform if one of the input arguments is a waveform (and none is a family).
<i>n_result</i>	Returns a number if both the input arguments are numbers.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
pow( average( v( "/net9" ) ) 0.5 )
```

Gets the square root of the average value of the voltage at `"/net9"`.

```
pow( 2 3 )  
=> 8
```

Gets the value of 2 to the third power, or 8.

```
pow( -2 2 )  
=> 4
```

Gets the value of -2 to the second power.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

```
pow( 2.5 -1.2 )  
=> 0.3330213
```

Gets the value of 2.5 to the power of -1.2.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

prms

```
prms (
    o_waveform
    n_from
    n_to
    [ n_period [ n_sfactor ] ]
)
=> o_waveform / nil
```

Description

Computes the periodic root mean square of a family of signals for each time point, which is the square root of the periodic average of the square of the input waveform.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like <code>srrWave:XXXXX.</code>).
<i>n_from</i>	Starting numeric value for the range on the X-axis.
<i>n_to</i>	Ending numeric value for the range on the X-axis.
<i>n_period</i>	Numeric value for the period of the input waveform.
<i>n_sfactor</i>	Sampling factor. This can be increased in order to increase the accuracy of the output. Default value: 1

Values Returned

<i>o_waveform</i>	Returns a waveform representing the periodic root mean square of a family of signals.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
prms v("/net8") ?from 1n ?to 20n ?period 2n ?sfactor 1)
```

Returns the value of the periodic root mean square for the family of waveforms representing the voltage of `/net8`.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

psd

```
psd(  
    o_waveform  
    f_timeStart  
    f_timeEnd  
    x_num  
    [ ?windowName t_windowName ]  
    [ ?smooth x_smooth ]  
    [ ?cohGain f_cohGain ]  
    [ ?windowSize x_windowSize ]  
    [ ?detrending t_detrending ]  
)  
=> o_waveformReal / nil
```

Description

Returns an estimate for the power spectral density of *o_waveform*. If *x_windowSize* is not a power of 2, it is forced to the next higher power of 2. If *x_num* is less than *x_windowSize*, *x_num* is forced to *x_windowSize*.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Time domain waveform object with units of volts or amps.
<i>f_timeStart</i>	Starting time for the spectral analysis interval. Use this parameter and <i>f_timeEnd</i> to exclude part of the interval. For example, you might set these values to discard initial transient data.
<i>f_timeEnd</i>	Ending time for the spectral analysis interval.
<i>x_num</i>	The number of time domain points to use. The maximum frequency in the Fourier analysis is proportional to <i>x_num</i> and inversely proportional to the difference between <i>f_timeStart</i> and <i>f_timeEnd</i> . Default value: 512
?windowName <i>t_windowName</i>	The window to be used for applying the moving window FFT. Valid values: Blackman, Cosine2, Cosine4, ExtCosBell, HalfCycleSine, Half3CycleSine or HalfCycleSine3, Half6CycleSine or HalfCycleSine6, Hamming, Hanning, Kaiser, Parzen, Rectangular, Triangle, Triangular, or Nuttall. Default value: Hanning
?smooth <i>x_smooth</i>	The Kaiser window smoothing parameter. The 0 value requests no smoothing. Valid values: $0 \leq x_smooth \leq 15$. Default value: 1
?cohGain <i>f_cohGain</i>	A scaling parameter. A non-zero value scales the power spectral density by $1/(f_cohGain)$. Valid values: $0 < f_cohGain < 1$ (You can use 1 if you do not want the scaling parameter to be used) Default value: 1
?windowSize <i>x_windowSize</i>	

OCEAN Reference

Predefined and Waveform (Calculator) Functions

The number of frequency domain points to use in the Fourier analysis. A larger window size results in an expectation operation over fewer samples, which leads to larger variations in the power spectral density. A small window size can smear out sharp steps in the power spectral density that might really be present.

Default value: 256

`?detrending t_detrending`

The detrending mode to use.

Valid values: `mean`, `linear`, `none`

Default value: `none`

The `psd` function works by applying a moving windowed FFT to time-series data. If there is a deterministic trend to the underlying data, you might want to remove the trend before performing the spectral analysis. For example, consider analyzing phase noise in a VCO model. Without the noise, the phase increases more or less linearly with time, so it is appropriate to set the detrending mode to `'linear`. To subtract an average value, set the detrending mode to `'mean`. Where the spectrum of raw data is desired, set the detrending mode to `none`.

Value Returned

`o_waveformReal`

The power spectral density waveform returned when the command is successful.

`nil`

Returns `nil` when the command fails.

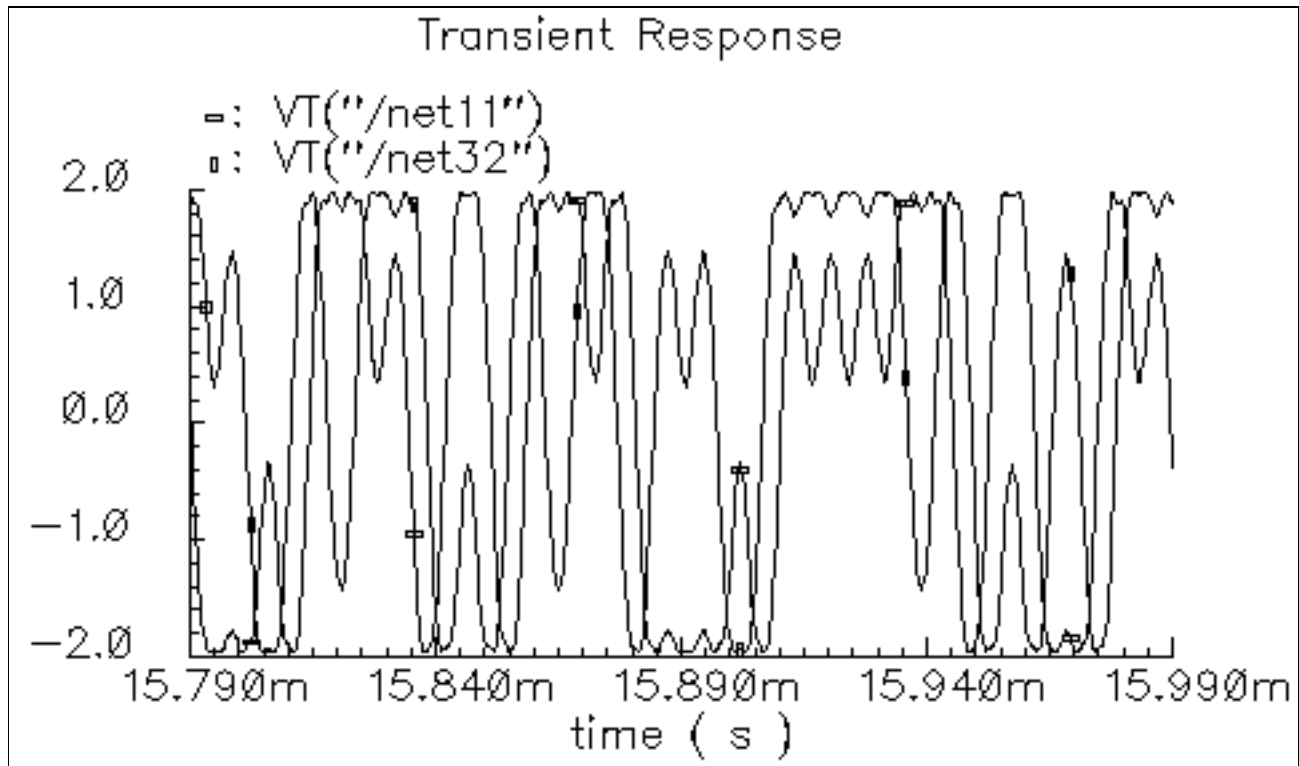
Example

```
psd(VT("/net32" "/hm/test_bench/spectre/schematic"), 0, 16m, 12000,  
    ?windowName 'Hanning, ?smooth 1, ?windowSize 256,  
    ?detrending 'None, ?cohGain 1)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

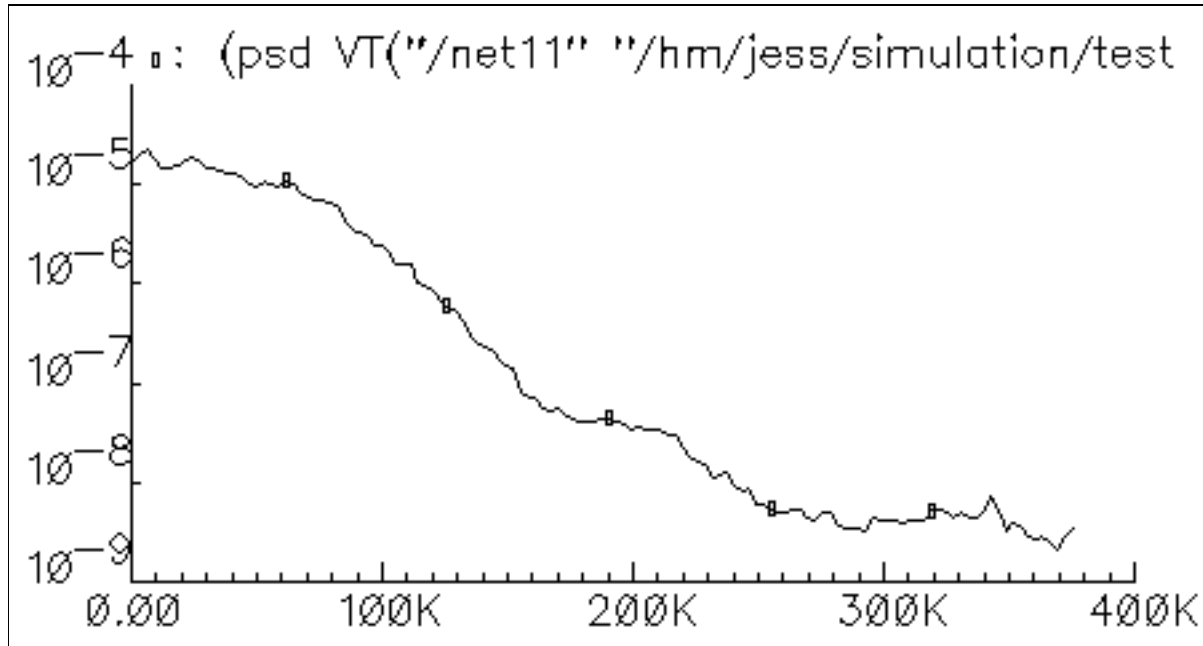
Consider applying this command to one of the waveforms in the following illustration.



OCEAN Reference

Predefined and Waveform (Calculator) Functions

The result is the following spectrum, which is displayed with a logarithmic vertical scale.



OCEAN Reference

Predefined and Waveform (Calculator) Functions

psdbb

```
psdbb(  
    o_waveform1  
    o_waveform2  
    f_timeStart  
    f_timeEnd  
    x_num  
    [ ?windowName t_windowName ]  
    [ ?smooth x_smooth ]  
    [ ?cohGain f_cohGain ]  
    [ ?windowSize x_windowSize ]  
    [ ?detrending t_detrending ]  
)  
=> o_waveformReal / nil
```

Description

Returns an estimate for the power spectral density of $o_waveform1 + j * o_waveform2$. If $x_windowSize$ is not a power of 2, it is forced to the next higher power of 2. If x_num is less than $x_windowSize$, x_num is forced to $x_windowSize$.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform1</i>	Time domain waveform object with units of volts or amps.
<i>o_waveform2</i>	Time domain waveform object with units of volts or amps.
<i>f_timeStart</i>	Starting time for the spectral analysis interval. Use this parameter and <i>f_timeEnd</i> to exclude part of the interval. For example, you might set these values to discard initial transient data.
<i>f_timeEnd</i>	Ending time for the spectral analysis interval.
<i>x_num</i>	The number of time domain points to use. The maximum frequency in the Fourier analysis is proportional to <i>x_num</i> and inversely proportional to the difference between <i>f_timeStart</i> and <i>f_timeEnd</i> .
?windowName <i>t_windowName</i>	<p>The window to be used for applying the moving window FFT.</p> <p>Valid values: Blackman, Cosine2, Cosine4, ExtCosBell, HalfCycleSine, Half3CycleSine or HalfCycleSine3, Half6CycleSine or HalfCycleSine6, Hamming, Hanning, Kaiser, Parzen, Rectangular, Triangle, Triangular, or Nuttall.</p> <p>Default value: Hanning</p>
?smooth <i>x_smooth</i>	<p>The Kaiser window smoothing parameter. 0 requests no smoothing.</p> <p>Valid values: $0 \leq x_smooth \leq 15$.</p> <p>Default value: 1</p>
?cohGain <i>f_cohGain</i>	<p>A scaling parameter. A non-zero value scales the power spectral density by $1/(f_cohGain)$. Valid values: $0 < f_cohGain < 1$ (You can use 1 if you do not want the scaling parameter to be used)</p> <p>Default value: 1</p>
?windowSize <i>x_windowSize</i>	

OCEAN Reference

Predefined and Waveform (Calculator) Functions

The number of frequency domain points to use in the Fourier analysis. A larger window size results in an expectation operation over fewer samples, which leads to larger variations in the power spectral density. A small window size can smear out sharp steps in the power spectral density that might really be present.

Default value: 256

`?detrending t_detrending`

The detrending mode to use.

Valid values: mean, linear, none

Default value: none

The `psd` function works by applying a moving windowed FFT to time-series data. If there is a deterministic trend to the underlying data, you might want to remove the trend before performing the spectral analysis. For example, consider analyzing phase noise in a VCO model. Without the noise, the phase increases more or less linearly with time, so it is appropriate to set the detrending mode to 'linear'. To subtract an average value, set the detrending mode to 'mean'. Where the spectrum of raw data is desired, set the detrending mode to 'none'.

Value Returned

`o_waveformReal` The power spectral density waveform returned when the command is successful.

`nil` Returns `nil` when the command fails.

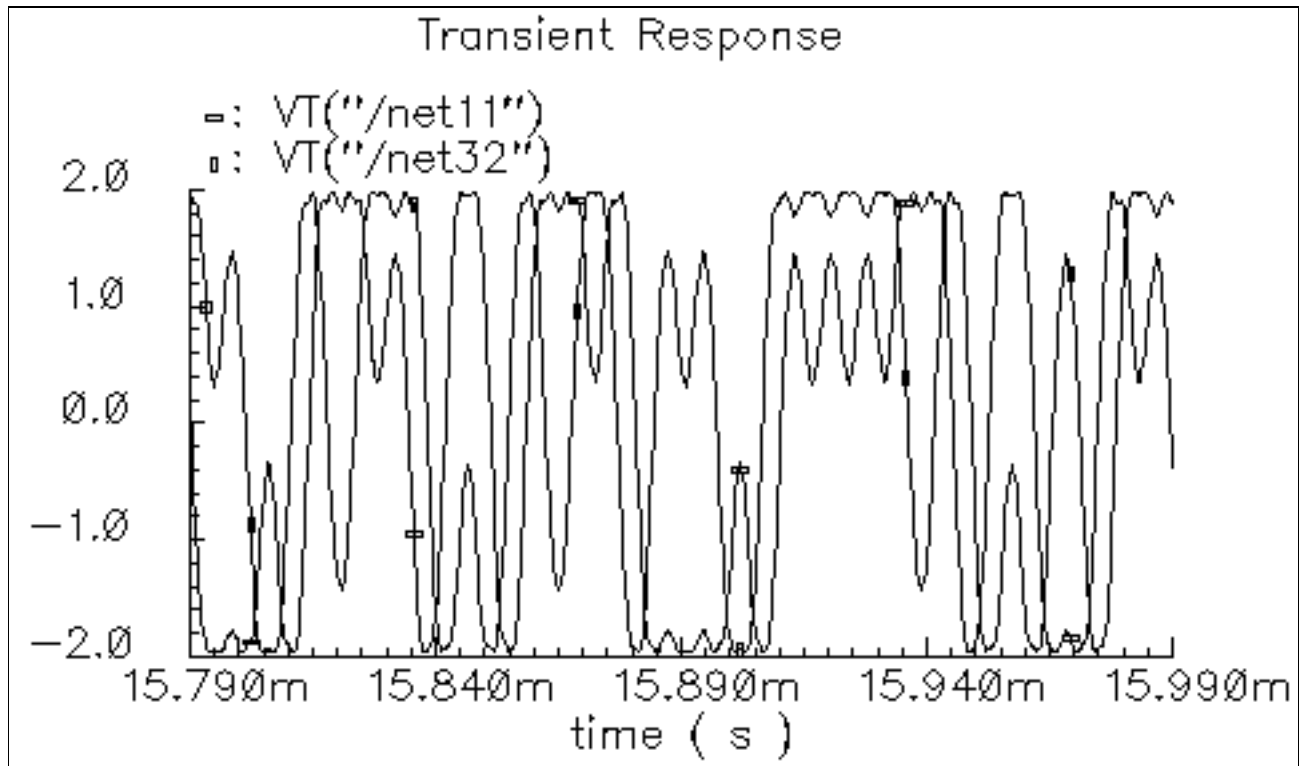
Example

```
psdbb(VT("/net32" "/hm/test_bench/spectre/schematic"),
      VT("/net11" "/hm/test_bench/spectre/schematic"), 0, 16m, 12000,
      ?windowName 'Hanning, ?smooth 1, ?windowSize 256,
      ?detrending 'None, ?cohGain 1)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

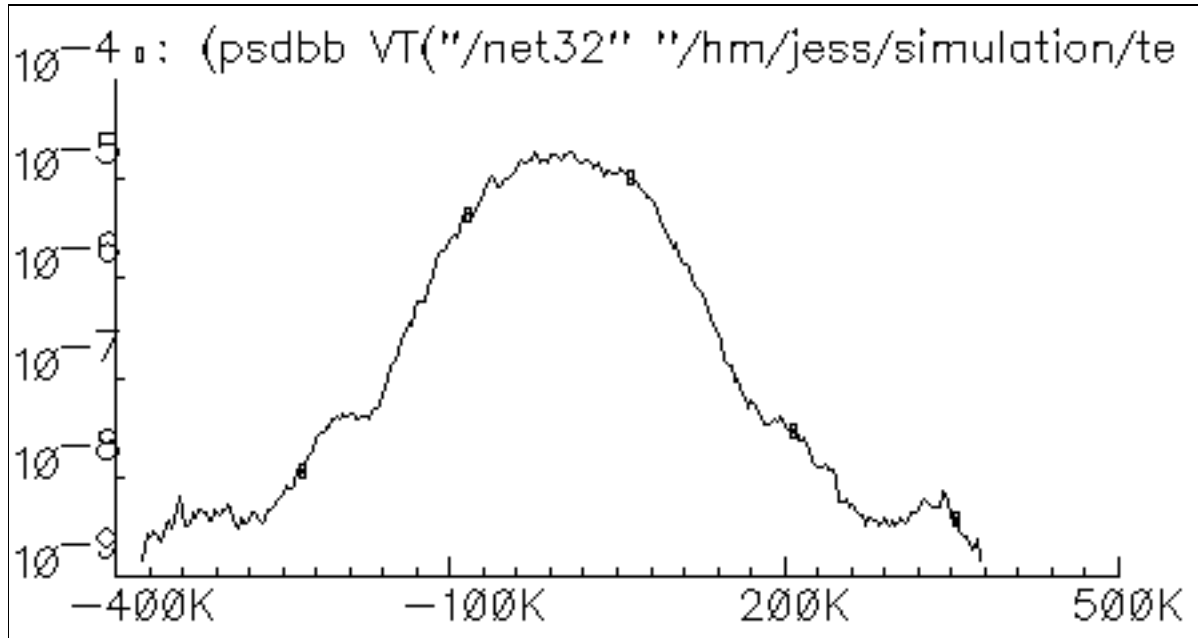
Consider applying this command to both of the waveforms in the following illustration.



OCEAN Reference

Predefined and Waveform (Calculator) Functions

The result is the following spectrum, which is displayed with a logarithmic vertical scale.



OCEAN Reference

Predefined and Waveform (Calculator) Functions

pstddev

```
pstddev(  
    o_waveform  
    n_from  
    n_to  
    [ n_period [ n_sfactor ] ]  
)  
=> o_waveform / nil
```

Definition

Computes the periodic standard deviation of a family of signals for each time point.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like <code>srrWave:XXXXX</code> .)
<i>n_from</i>	Starting numeric value for the range on the X-axis.
<i>n_to</i>	Ending numeric value for the range on the X-axis.
<i>n_period</i>	Numeric value for the period of the input waveform.
<i>n_sfactor</i>	Sampling factor. This can be increased in order to increase the accuracy of the output. Default value: 1

Values Returned

<i>o_waveform</i>	Returns a waveform representing the periodic standard deviation of a family of signals.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
pstddev( v("/net8") ?from 1n ?to 20n ?period 2n ?sfactor 1)
```

Returns the value of the periodic standard deviation for the family of waveforms representing the voltage of `/net8`

OCEAN Reference

Predefined and Waveform (Calculator) Functions

pzbode

```
pzbode (
    f_transferGain
    f_minfrequency
    f_maxfrequency
    x_nponits
    [ ?poles o_waveform1 ]
    [ ?zeros o_waveform2 ]
)
=> o_waveform / nil
```

Description

Calculates and plots the transfer function of a circuit from pole zero simulation data.

Note: This command also works for the parametric or sweep data.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>f_transferGain</i>	The transfer gain constant.
<i>f_minfrequency</i>	The minimum frequency for the bode plot.
<i>f_maxfrequency</i>	The maximum frequency for the bode plot.
<i>x_npoints</i>	The frequency interval for the bode plot, in points per decade.
<i>?poles waveform1</i>	Poles from the dumped simulation data. Default value: all
<i>?zeros o_waveform2</i>	Zeros from the dumped simulation data. Default value: all

Value Returned

<i>o_waveform</i>	Waveform containing the X and Y points of the transfer function. The scale of the Y-axis will be db20.
<i>nil</i>	Returns <i>nil</i> and error message otherwise.

Example

```
pzbode( 1.0 1M 1G 20 ?poles complexPoleWave ?zeros complexZeroWave )
```

pzfilter

```
pzfilter(  
    [ o_PoleWaveform ]  
    [ o_ZeroWaveform ]  
    [ ?maxfreq t_maxfreq ]  
    [ ?reldist n_reldist ]  
    [ ?absdist n_absdist ]  
    [ ?minq n_minq ]  
    [ ?output_type o_output ]  
)  
=> o_waveform / nil
```

Description

Returns the filtered Pole and Zero waveforms.

Note: If you do not specify values for *o_PoleWaveform* and *o_ZeroWaveform* arguments, you should have run pz analysis prior to using this function. This command also works for the parametric or sweep data.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_PoleWaveform</code>	Input Pole waveform (complex points). Default value: Poles of the simulator pz-analysis dump
<code>o_ZeroWaveform</code>	Input Zero waveform (complex points). Default value: Zeros of the simulator pz-analysis dump
<code>t_maxfreq</code>	Maximum frequency. Default value: 1e10
<code>?reldist n_reldist</code>	Relative distance to be considered while filtering. Default value: 0.05
<code>?absdist n_absdist</code>	Absolute distance to be considered while filtering. Default value: 1e-6
<code>?minq n_minq</code>	Minimum q factor to be allowed while filtering.
<code>?output_type o_output</code>	Specifies the type of the output. If this argument is not passed, the output is a family of waves with two child waveforms, representing poles and zeros respectively, with the real component of each waveform as the X values and the imaginary components as the Y values. Valid value: <code>complexwave</code> . The output is a family of waves with two child waves, both of which are complex and represent poles and zeros, respectively.

Value Returned

<code>o_waveform</code>	Returns a family (waveform) of Pole and Zero waveforms.
<code>nil</code>	Returns <code>nil</code> otherwise.

Example

```
pzfilter( complexPoleWave complexZeroWave )  
=> srrWave:175051584
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Returns a family of filtered Pole and Zero waveforms, which correspond to the sweep values of “Pole” and “Zero”, respectively.

rapidIPNCurves

```
rapidIPNCurves(  
    o_result  
    [ ?resultsDir t_resultsDir ]  
    [ ?resistance n_resistance ]  
    @Rest args  
)  
=> o_waveformReal / nil
```

Description

Plots IPN curves.

Arguments

<code>o_result</code>	Object representing simulation results that can be displayed as a series of points on a grid.
<code>?resultsDir t_resultsDir</code>	Name of the directory where results are saved.
<code>?resistance n_resistance</code>	Value of resistance Default value: 50
<code>@Rest l_args</code>	List of arguments to be used by the value function on the results data. Refer to the value function for more details.

Value Returned

<code>o_waveformReal</code>	Returns a waveform.
<code>nil</code>	Returns <code>nil</code> or an error message otherwise.

Example

```
w2 = rapidIPNCurves("ac-ip3" ?resultsDir "./simulation/amplifier/spectre/  
schematic/psf" ?r 50)
```

rapidIIPN

```
rapidIIPN(  
    o_result  
    [ ?resultsDir t_resultsDir ]  
    [ ?resistance n_resistance ]  
    @Rest args  
)  
=> o_waveform / nil
```

Description

Plots the input IPN curves.

Arguments

<i>o_result</i>	Object representing simulation results that can be displayed as a series of points on a grid.
<i>?resultsDir t_resultsDir</i>	Name of the directory where results are saved.
<i>?resistance n_resistance</i>	Value of resistance Default value: 50
<i>l_args</i>	List of arguments to be used by the value function on the results data. Refer to the value function for more details.

Value Returned

<i>o_waveform</i>	Returns a waveform.
<i>nil</i>	Returns <i>nil</i> or an error message otherwise.

Example

```
rapidIIPN("hbac_ip3")
```


OCEAN Reference

Predefined and Waveform (Calculator) Functions

real

```
real(  
    { o_waveform | n_input }  
)  
=> o_waveformReal / n_numberReal / nil
```

Description

Returns the real part of a waveform representing a complex number, or returns the real part of a complex number.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_input</i>	Complex number.

Value Returned

<i>o_waveformReal</i>	Returns a waveform when the input argument is a waveform.
<i>n_numberReal</i>	Returns a number when the input argument is a number.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
real( v( "/net8" ) )
```

Returns a waveform representing the real part of the voltage of `/net8`. You also can use the `vr` alias to perform the same command, as in `vr("net8"`).

```
x=complex( -1 -2 ) => complex(-1, -2)  
real( x ) => -1.0
```

Creates a variable `x` representing a complex number, and returns the real portion of that complex number.

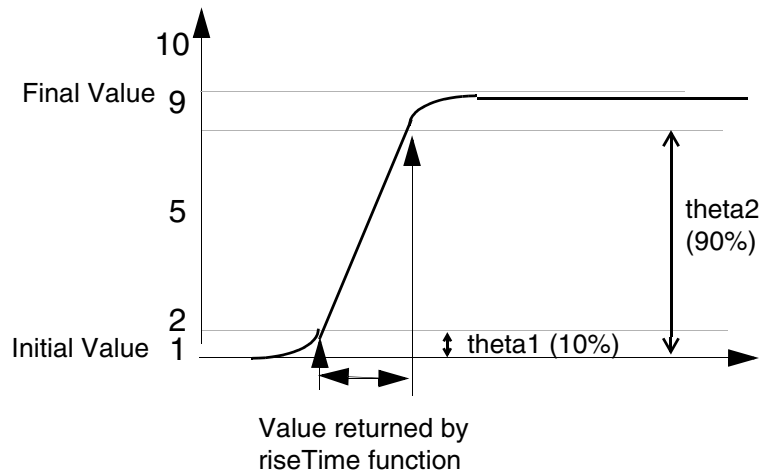
riseTime

```
riseTime(  
    o_waveform  
    n_initVal  
    g_initType  
    n_finalVal  
    g_finalType  
    n_theta1  
    n_theta2  
    [ g_multiple [ s_Xname ] [ g_histoDisplay ] [ x_noOfHistoBins ] ]  
)  
=> o_waveform / n_value / nil
```

Description

Returns the rise time measured between *theta1* (percent low) to *theta2* (percent high) of the difference between the initial value and the final value.

The `riseTime` function can also be used to compute the fall time if *initVal* is higher than *finalVal*.



OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_initVal</i>	Initial value at which to start the computation.
<i>g_initType</i>	<p>Specifies how <i>n_initVal</i> functions.</p> <p>Valid values: a non-nil value specifies that the initial value is taken to be the value of the waveform, interpolated at <i>n_initVal</i>, and the waveform is clipped from below as follows:</p> <pre><i>o_waveform</i> = clip(<i>o_waveform</i> <i>g_initVal</i> nil)</pre> <p>where <code>nil</code> specifies that <i>n_initVal</i> is defined by the X value entered. (The command gets the Y value for the specified X value and uses that value for <i>n_initVal</i>.)</p>
<i>n_finalVal</i>	Final value at which to end the computation.
<i>g_finalType</i>	<p>Specifies how the <i>n_finalVal</i> argument functions.</p> <p>Valid values: a non-nil value specifies that the final value is taken to be the value of the waveform, interpolated at <i>n_finalVal</i>, and the waveform is clipped from above, as follows:</p> <pre><i>o_waveform</i> = clip(<i>o_waveform</i> nil <i>n_finalVal</i>)</pre> <p>where <code>nil</code> specifies that the <i>n_finalVal</i> argument is defined by the X value entered. (The command gets the Y value for the specified X value and uses that value for <i>n_finalVal</i>.)</p>
<i>n_theta1</i>	Percent low.
<i>n_theta2</i>	Percent high.
<i>g_multiple</i>	An optional boolean argument that takes the value <code>nil</code> by default. If set to <code>t</code> , the function returns multiple occurrences of the <code>riseTime</code> event.
<i>s_xName</i>	<p>An optional argument that is used only when <i>g_multiple</i> is set to <code>t</code>. It takes the value <code>time</code> by default. It controls the contents of the x vector of the waveform object returned by the function.</p> <p>Valid values: <code>'time</code>, <code>'cycle</code></p>

OCEAN Reference

Predefined and Waveform (Calculator) Functions

<i>g_histoDisplay</i>	<p>When set to <code>t</code>, returns a waveform that represents the statistical distribution of the <code>riseTime</code> data in the form of a histogram. The height of the bars (bins) in the histogram represents the frequency of the occurrence of values within the range of <code>riseTime</code> data.</p> <p>Valid values: <code>t</code> <code>nil</code></p> <p>Default value: <code>nil</code></p>
<i>x_noOfHistoBins</i>	<p>Denotes the number of bins represented in the histogram representation.</p> <p>Valid values: Any positive integer</p> <p>Default value: <code>nil</code></p>

Note: *g_histoDisplay* and *x_noOfHistoBins* are added for backward compatibility only. It will be deprecated in future releases. Use the `histo` function for plotting the histogram of the resulting function.

Value Returned

<i>o_waveform</i>	Returns a waveform representing the rise time for a family of waveforms if the input argument is a family of waveforms or if <i>g_multiple</i> is set to <code>t</code> .
<i>n_value</i>	Returns a value for the rise time if the input is a single waveform.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
riseTime( v( "/net8" ) 0 t 2 t 10 90 )
```

Computes the rise time for the waveform representing the voltage of `"/net8"` from 0 to 2.

For the next example, assume that `v` is the following sinusoidal waveform:

```
sin( 2 * pi * time)
riseTime( v 0.25 t 0.5 t 10 90)
```

Computes the fall time of the first falling edge from 1 to 0.

```
riseTime(VT("/out") 0.5 nil 4.5 nil 10 90 t "time") (s)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Returns multiple occurrences of riseTime specified against time-points at which each riseTime event occurs.

```
riseTime(VT("/out") 0.5 nil 4.5 nil 10 90 t "cycle") (s)
```

Returns multiple occurrences of riseTime specified against cycle numbers, where a cycle number refers to the n'th occurrence of the riseTime event in the input waveform.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

rms

```
rms (
    o_waveform
)
=> o_waveform / n_value / nil
```

Description

Returns the root-mean-square value of a waveform.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform representing the root-mean-square value for a family of waveforms if the input argument is a family of waveforms.
<i>n_value</i>	Returns a value for the root-mean-square value for the specified waveform if the input is a single waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
rms( v( "/out" ) )
```

Returns the root-mean-square value of the waveform representing the voltage of the `"/out"` net.

rmsNoise

```
rmsNoise(  
    n_from  
    n_to  
)  
=> o_waveform / n_value / nil
```

Description

Computes the integrated root-mean-square noise over the specified bandwidth.

Arguments

<i>n_from</i>	Frequency in hertz that specifies the minimum value for the bandwidth.
<i>n_to</i>	Frequency in hertz that specifies the maximum value for the bandwidth.

Value Returned

<i>o_waveform</i>	Returns a waveform (or a family of waveforms) representing the integrated root-mean-square noise if the data being analyzed is parametric.
<i>n_value</i>	Returns a value for the integrated root-mean-square noise if the data being analyzed is from a single simulation run.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
rmsNoise( 100 100M )  
=> 250e-6
```

Computes the integrated root-mean-square noise from 100 to 100M.

rmsVoltage

```
rmsVoltage(  
    t_net  
    [ t_net1 ]  
)  
=> f_voltage / nil
```

Description

Calculates the root-mean-square voltage between two nets for fast and regular envelop analysis.

Arguments

<i>t_net</i>	Name of the net selected in the schematic.
<i>t_net1</i>	Name of the second net selected in the schematic. This argument is optional. If not specified, the default value is assumed as <i>gnd</i> .

Value Returned

<i>f_voltage</i>	Returns a value in terms of voltage.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
rmsVoltage( "net1" "!gnd")  
=> 120
```

Calculates the root-mean-square voltage between *net1* and *gnd*.

rmsTerminalVoltage

```
rmsTerminalVoltage(
    t_terminal
    [ t_terminal1 ]
)
=> f_voltage / nil
```

Description

Calculates the root-mean-square voltage between two terminals for fast and regular envlp analysis.

Arguments

<i>t_terminal</i>	Name of the terminal selected in the schematic.
<i>t_terminal1</i>	Name of the second terminal selected in the schematic. This argument is optional. If not specified, the default value is assumed as <code>gnd</code> .

Value Returned

<i>f_voltage</i>	Returns a value in terms of voltage.
<i>nil</i>	Returns <code>nil</code> or an error message.

Example

If the following expression is created and plotted:

```
clip(psd(b(real(harmonic(v("/I19/M4/G" ?result "envlp_fd" ?type 'terminalV) 1))
imag(harmonic(v("/I19/M4/G" ?result "envlp_fd" ?type 'terminalV) 1)) 0.0 1e-08 4
?windowName "Hanning" ?windowSize 4 ?detrending "None") 0.0 1e+07)
```

The rms terminal voltage function creates the following expression:

```
rmsTerminalVoltage("IO/M1/D")
```

If the result is re-evaluated, the scalar value is added to the ADE output.

testcase: mixer...	RMS Voltage	1.506
--------------------	-------------	-------

OCEAN Reference

Predefined and Waveform (Calculator) Functions

root

```
root(  
    o_waveform  
    n_rootVal  
    x_n )  
  
=> o_waveform / n_value / l_value / nil
```

Description

Returns the *n*th X value at which the Y value equals the specified Y value (*rootVal*).

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_rootVal</i>	Y value of interest.
<i>x_n</i>	Number that specifies which X value to return. If <i>n</i> equals 1, the first X value that crosses over the Y <i>rootVal</i> is returned. If <i>n</i> equals 2, the second X value that crosses over the Y <i>rootVal</i> is returned, and so on. If you specify a negative integer for <i>n</i> , the X values that cross the <i>rootVal</i> are counted from right to left (from maximum to minimum). If you specify <i>n</i> as 0, the list of root values is returned.

Value Returned

<i>o_waveform</i>	Returns a waveform if the input argument is a family of waveforms.
<i>n_value</i>	Returns an X value when the input argument is a single waveform.
<i>l_value</i>	Returns a list of all the root values when <i>n</i> is 0.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

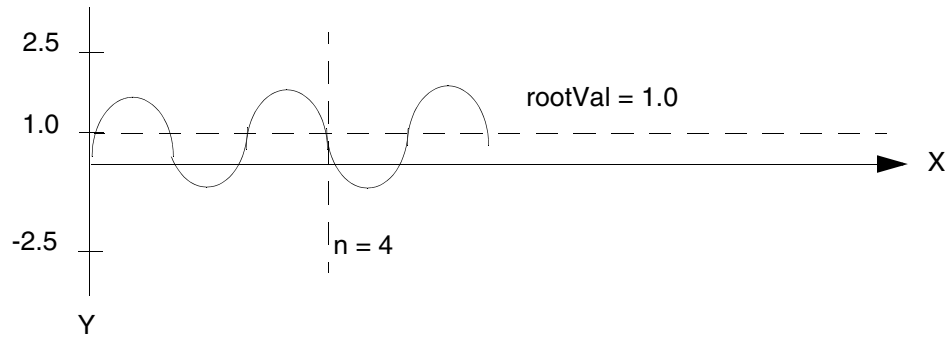
Example

```
root( v( "vout" ), 1.0, 4 )
```

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Predefined and Waveform (Calculator) Functions

Returns the X value for the point at which the waveform curve crosses the 1.0 Y value for the fourth time.



rshift

```
rshift(  
    o_waveform  
    n_delta  
)  
=> o_waveform / nil
```

Description

Shifts the waveform to the right by the *n_delta* value.

This command is the inverse of the lshift command.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

<i>n_delta</i>	Value by which the waveform is to be shifted.
----------------	---

Value Returned

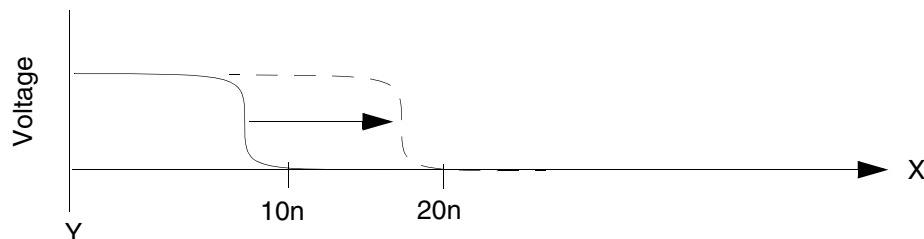
<i>o_waveform</i>	Returns a waveform object. Returns a family of waveforms if the input argument is a family of waveforms.
-------------------	--

<i>nil</i>	Returns <code>nil</code> and an error message otherwise.
------------	--

Example

```
rshift( v( "vout" ) ) 10n )
```

Shifts the waveform representing the voltage through the "vout" net to the right by 10n.



sample

```
sample(  
    o_waveform  
    n_from  
    n_to  
    t_type  
    n_by  
)  
=> o_waveform / n_number / nil
```

Description

Samples a waveform at the specified interval.

You can use this function to reduce the time it takes to plot waveforms that have many data points. If you sample a waveform beyond its range, you get the final value of the waveform. You can use this function to demodulate a signal. Consider an AM modulated sine wave. Assume the carrier frequency is 1 GHz, and the modulation frequency is 1 MHz. If the waveform is sampled every 1 ns, the resulting signal is cleanly demodulated (the 1 GHz carrier is completely eliminated by the sampling).

Note: The function can be used to sample both a waveform object as well as a family of waveforms. If the family is of dimension m , the arguments *n_from*, *n_to*, and *n_by* would be of dimension $m-1$.

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Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_from</i>	Starting value for the sampling.
<i>n_to</i>	Ending value for the sampling.
<i>t_type</i>	Type of the sampling. Valid values: "linear" or "log"
<i>n_by</i>	Interval at which to sample.

Value Returned

<i>o_waveform</i>	Returns a waveform representing the sampling you specified.
<i>n_number</i>	Returns a number if the output contains only one point.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
sample( v( "vout" ) 0 50n "linear" 0.1n )
```

Takes a linear sample of the waveform representing the voltage of the "vout" net.

```
sample( v( "vout" ) 0 100m "log" 10 )
```

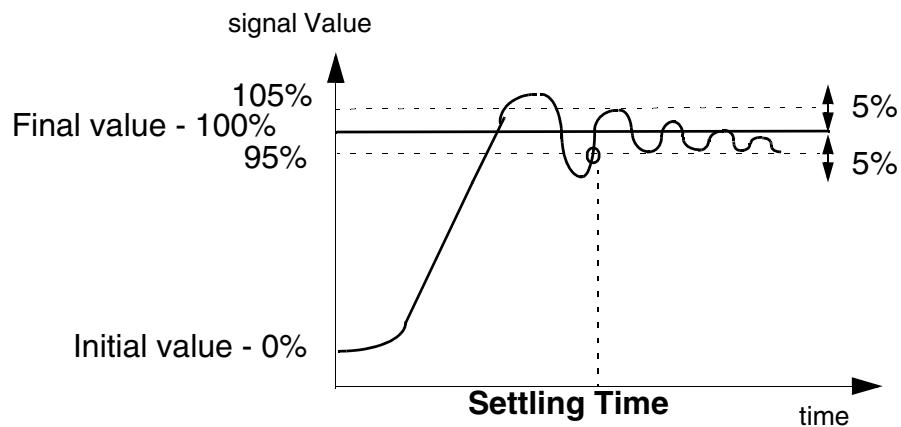
Takes a logarithmic sample of the waveform representing the voltage of the "vout" net.

settlingTime

```
settlingTime(  
    o_waveform  
    n_initVal  
    g_initType  
    n_finalVal  
    g_finalType  
    n_theta  
    [ g_multiple [ s_Xname ] ]  
)  
=> o_waveform / n_value / nil
```

Description

The settling time is the time by which the signal settles within the specified Percent of step (theta) of the difference between the Final Value and Initial Value from the Final Value.



Note: The above graph represents the Initial value of the signal as 0% and Final value as 100%. The Percent of Step is taken as 5%.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_initVal</i>	Initial value at which to start the computation.
<i>g_initType</i>	Specifies whether the values entered are X values or Y values. Valid values: <code>t</code> specifies that <i>initVal</i> is defined by the X value entered; <code>nil</code> specifies that <i>initVal</i> is defined by the Y value entered
<i>n_finalVal</i>	Final value at which to start the computation.
<i>g_finalType</i>	Specifies whether the values entered are X values or Y values. Valid values: <code>t</code> specifies that <i>finalVal</i> is defined by the X value entered; <code>nil</code> specifies that <i>finalVal</i> is defined by the Y value entered
<i>n_theta</i>	Percent of the total step. <i>g_multiple</i> An optional boolean argument that takes the value <code>nil</code> by default. If set to <code>t</code> , the function returns multiple occurrences of the <code>settlingTime</code> event.
<i>s_xName</i>	An optional argument that is used only when <i>g_multiple</i> is set to <code>t</code> . It takes the value <code>time</code> by default. It controls the contents of the x vector of the waveform object returned by the function. Valid values: <code>'time</code> , <code>'cycle</code>

Additional Information

The equation used to calculate maximum delta value is:

```
maxDeltaY = ((theta/100.0)*abs(FinalVal-InitVal))
```

Firstly, check if the absolute difference between the last element of the waveform and *finalVal* is less than *maxDeltaY*. If yes, then compute `settlingTime`, else returns `nil`.

To compute `settlingTime`, subtract *finalVal* from the waveform, get the subtracted-wave and calculate settling time as first cross on subtracted-wave at *maxDeltaY* (from opposite direction for falling edge). If no such crossing exists, then return 0.0.

```
maxDeltaY = ((theta/100.0) * abs(FinalVal -InitVal))
```


OCEAN Reference

Predefined and Waveform (Calculator) Functions

```
if( abs(last_Y_element_of_waveform - finalVal) < maxDeltaY then
    or( cross( abs(waveform - finalVal)  maxDeltaY -1 -1) 0.0)
else
    nil
)
```

Value Returned

<i>o_waveform</i>	Returns a waveform representing the settling time for a family of waveforms if the input argument is a family of waveforms or if <i>g_multiple</i> is set to <i>t</i> .
<i>n_value</i>	Returns a value for the settling time for the specified waveform if the input is a single waveform.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
settlingTime( v("/out" ) 0 t 2 t 90 )
```

Computes the time required for the waveform representing the voltage of the `/out` net to settle within 90 percent of the step from 0 to 2.

```
settlingTime(VT("/out") 0.5 nil 4.95 nil 5 t "time") (s)
```

Returns multiple occurrences of `settlingTime` specified against time-points at which each `settlingTime` event occurs.

```
settlingTime(VT("/out") 0.5 nil 4.95 nil 5 t "cycle") (s)
```

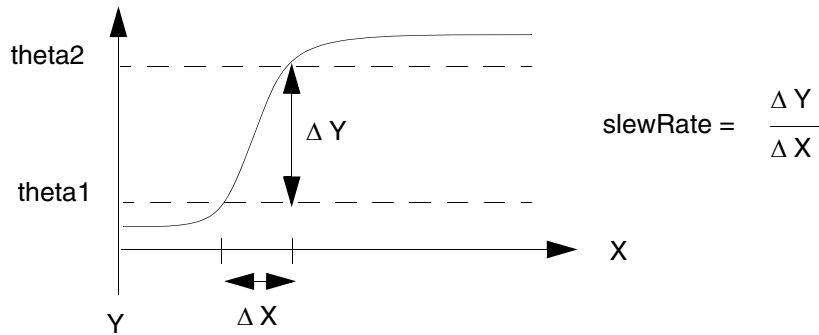
Returns multiple occurrences of `settlingTime` specified against cycle numbers, where a cycle number refers to the *n*'th occurrence of the `settlingTime` event in the input waveform.

slewRate

```
slewRate(  
    o_waveform  
    n_initVal  
    g_initType  
    n_finalVal  
    g_finalType  
    n_theta1  
    n_theta2  
    [ g_multiple [ s_Xname ] ]  
    [ g_histoDisplay ] [ x_noOfHistoBins ]  
)  
=> o_waveform / n_value / nil
```

Description

Computes the average rate at which an expression changes from *theta1* (percent low) to *theta2* (percent high) of the difference between the initial value and final value.



OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_initVal</i>	Initial X-axis value at which to start the computation.
<i>g_initType</i>	Specifies whether the values entered are X values or Y values. Valid values: <code>t</code> specifies that <i>initVal</i> is defined by the X value entered; <code>nil</code> specifies that <i>initVal</i> is defined by the Y value entered
<i>n_finalVal</i>	Final value at which to end the computation.
<i>g_finalType</i>	Specifies whether the values entered are X values or Y values. Valid values: <code>t</code> specifies that <i>finalVal</i> is defined by the X value entered; <code>nil</code> specifies that <i>finalVal</i> is defined by the Y value entered
<i>n_theta1</i>	Percent low (percentage of the total step).
<i>n_theta2</i>	Percent high (percentage of the total step).
<i>g_multiple</i>	An optional boolean argument that takes the value <code>nil</code> by default. If set to <code>t</code> , the function returns multiple occurrences of the <code>slewRate</code> event.
<i>s_xName</i>	An optional argument that is used only when <i>g_multiple</i> is set to <code>t</code> . It takes the value <code>time</code> by default. It controls the contents of the x vector of the waveform object returned by the function. Valid values: <code>'time</code> , <code>'cycle</code>
<i>g_histoDisplay</i>	When set to <code>t</code> , returns a waveform that represents the statistical distribution of the <code>riseTime</code> data in the form of a histogram. The height of the bars (bins) in the histogram represents the frequency of the occurrence of values within the range of <code>riseTime</code> data. Valid values: <code>t</code> <code>nil</code> Default value: <code>nil</code>

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Predefined and Waveform (Calculator) Functions

x_noOfHistoBins Denotes the number of bins represented in the histogram representation.
Valid values: Any positive integer
Default value: `nil`

Note: *g_histoDisplay* and *x_noOfHistoBins* are added for backward compatibility only. It will be deprecated in future releases. Use the `histo` function for plotting the histogram of the resulting function.

Value Returned

o_waveform Returns a waveform representing the slew rate for a family of waveforms if the input argument is a family of waveforms or if *g_multiple* is set to `t`.
n_value Returns a value for the slew rate for the specified waveform if the input is a single waveform.
nil Returns `nil` or an error message otherwise.

Example

```
slewRate( v( "vout" ) 10n t 30n t 10 90 )
```

Computes the slew rate for the waveform representing the voltage of the "vout" net from 10n to 30n.

```
slewRate( v( "vout" ) 0 nil 10 nil 5 95 )
```

Computes the slew rate for the waveform representing the voltage of the "vout" net from 0 to 10. In this example, the initial value and final value are entered as Y values.

```
slewRate(VT("/out") 0.5 nil 4.5 nil 10 90 t `time)
```

Return multiple occurrences of `slewRate` values, computed at different time-points.

```
slewRate(VT("/out") 0.5 nil 4.5 nil 10 90 t `cycle)
```

Returns multiple occurrences of `slewRate` values specified against cycle numbers (where cycle number refers to the n'th occurrence of `slewRate` computation).

smithType

```
smithType(  
    x_mode  
)  
=> t / nil
```

Description

Sets the Smith display mode type for the active graph.

Arguments.

x_mode

Type of Smith display.

Valid Values:

- **impedance**: Circular graph, also known as Z Smith, where the region above the x-axis represents inductive impedances and the region below the x-axis represents capacitive impedances.
- **admittance**: Circular graph, also known as Y Smith, where the region above the x-axis represents capacitive admittances and the region below the x-axis represents inductive admittances.
- **polar**: plot graph, representing data using the polar coordinates system.

For more information on circular graphs, see the [Creating a Circular Graph](#) section in *Virtuoso Visualization and Analysis XL User Guide.s*

Value Returned

t

Returns *t* when the specified Smith display id set.

nil

Returns *nil* if there is an error.

Example

```
smithType("impedance")  
=>t
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Sets the Smith display to impedance.

spectralPower

```
spectralPower(  
    o_current  
    o_voltage  
)  
=> o_power / nil
```

Description

Returns the spectral power given the spectral current and voltage.

To obtain a list of the harmonic frequencies, use `harmonicList`.

Arguments

<i>o_current</i>	Waveform representing the current. The current can be obtained by calling the <code>i</code> data access function for the desired terminal.
------------------	---

Value Returned

<i>o_power</i>	Waveform representing the power of the net.
<i>nil</i>	Returns <code>nil</code> if there is an error.

Example

```
plot(db10(spectralPower(i("/PORT0/PLUS") v("/net28"))))
```

Plots power of the output `"/net28"`. `"/PORT0/PLUS"` is a member of `"/net28"`.

spectrumMeasurement

```
spectrumMeasurement(  
    o_waveform  
    g_isTimeWave  
    n_from  
    n_to  
    x_numSamples  
    n_startFreq  
    n_endFreq  
    x_signalBins  
    t_windowName  
    n_satLvl  
    g_isNoiseAnalysis  
    x_noOfHarmonics  
    t_measType  
)  
=> g_value / nil
```

Description

Calculates Signal-to-Noise-and-Distortion Ratio (SINAD), Spurious Free Dynamic Range (SFDR), Effective Number of Bits (ENOB), and Signal-to-Noise Ratio (without distortion) by using Fast Fourier Transform (FFT) of any given input signal.

The spectrum measure is used for characterizing A-to-D converters and is typically supported for transient simulation data.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>g_isTimeWave</i>	Boolean that specifies whether the input wave type is time domain waveform or frequency domain waveform.
<i>n_from</i>	The X-axis start value of the portion of input <i>o_waveform</i> to be used for FFT and subsequent calculations.
<i>n_to</i>	The X-axis end value of the portion of input <i>o_waveform</i> to be used for FFT and subsequent calculations.
<i>x_numSamples</i>	<p>Number of sampled points used for the FFT.</p> <p>Valid values: Any integer power of two greater than zero. For a value that is not a power of two, the function rounds it up to the next closest power of two.</p> <p>Default value: Number of data points in the <i>Signal</i>.</p>
<i>n_startFreq</i>	<p>Lower limit of frequency range for the spectrum measures.</p> <p>Default value: First frequency point of the FFT.</p>
<i>n_endFreq</i>	<p>Upper limit of frequency range for the spectrum measures.</p> <p>Default value: Last frequency point of the FFT.</p>
<i>x_signalBins</i>	<p>Number of signal bins. When you select a window type, this field displays the default number of bins for the selected window type.</p> <p>For example, if you select the <i>Window Type</i> as <code>Kaiser</code> that has two signal bins, this field displays 2. You can increase the number of signal bins to up to half the value of the sample count.</p> <p>For example, if the sample count is 16 for the window type <code>Kaiser</code>, you can increase the signal bin count in the <i>Signal Bins</i> field up to 8. You cannot decrease the displayed signal bin value. Valid values: 0 to 99.</p> <p>Default value: 0.</p>

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Predefined and Waveform (Calculator) Functions

<i>t_windowName</i>	<p>Windowing function applied to <i>o_wave</i> while applying the FFT for measurement calculations.</p> <p>Valid values: Blackman, Cosine2, Cosine4, ExtCosBell, HalfCycleSine, HalfCycleSine3, HalfCycleSine6, Hanning, Hamming, Kaiser, Parzen, Rectangular, and Triangular.</p> <p>Default value: Rectangular.</p>
<i>n_satLvl</i>	<p>Peak saturation level of the FFT waveform. Magnitude of the FFT wave is divided by the Peak Sat Level before using it in calculations. Peak sat level is the full-scale span ignoring any DC offsets and used in ENOB calculation. Valid values: Any floating point number.</p> <p>Default value: 0</p>
<i>g_isNoiseAnalysis</i>	<p>Boolean that specifies whether the analysis type is Signal Analysis or Noise Analysis.</p>
<i>x_noOfHarmonics</i>	<p>Number of harmonics for the waveform that you want to plot.</p> <p>For example, If this variable is <i>n</i>, where <i>n</i> should be greater than 1 and the fundamental frequency is harmonic 1, the <i>n</i> harmonics are considered for the harmonic power calculation. The signal bins are used for calculating the harmonic power.</p> <p>For example, to calculate the total harmonic distortion (THD), if you set the <i>Harmonics</i> value to <i>n</i>, where <i>n</i> is greater than 1, and the fundamental frequency is harmonic 1, the number of harmonics used to calculate THD is 2,...,<i>n</i>. If <i>n</i>=3, the 2nd and 3rd harmonics are used to calculate THD.</p>
<i>t_measType</i>	<p>Result specifier.</p> <p>Valid values: <i>sinad</i>, <i>sfdr</i>(db), <i>enob</i>, and <i>snhr</i>.</p> <p>Default value: <i>sinad</i></p>

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Value Returned

<i>g_value</i>	Returns the spectrum measure specified by the <i>t_measType</i> argument.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
spectrumMeasurement(v("/OUT" ?result "tran") t 0 3e-08 1024 0 1.25e+08 0  
"Rectangular" 0 0 1 "sinad")  
=> -0.07218201
```

Returns the value of the spectrum measure *sinad*, as specified by the *spectrumMeasurement* function.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

ssb

```
ssb (  
    o_s11  
    o_s12  
    o_s21  
    o_s22  
    g_frequency  
)  
=> o_waveform / nil
```

Description

Computes the source stability circles.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_s11</i>	Waveform object representing s11.
<i>o_s12</i>	Waveform object representing s12.
<i>o_s21</i>	Waveform object representing s21.
<i>o_s22</i>	Waveform object representing s22.
<i>g_frequency</i>	<p>Frequency. It can be specified as a scalar or a linear range. The frequency is swept if it is specified as a linear range. The linear range is specified as a list with three values: the start of the range, the end of the range, and the increment. For example, <code>list(100M 1G 100M)</code> specifies a linear range with the following values:</p> <pre>{ 100M, 200M, 300M, 400M, 500M, 600M, 700M, 800M, 900M, 1G }</pre> <p>In that case, a source stability circle is calculated at each one of the 10 frequencies.</p>

Value Returned

<i>o_waveform</i>	Waveform object representing the source stability circles.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot(ssb(s11 s12 s21 s22 list(800M 1G 100M)))
```

stddev

```
stddev(  
    o_waveform  
    [ ?overall overall ]  
    [ ?type t_type ]  
    [ ?continuous g_continuous ]  
)  
=> n_stddev / o_waveformStddev / nil
```

Description

Computes the standard deviation of a waveform (or a family of waveforms) over its entire range.

You can calculate the standard deviation for a population as well as for a sample. The population standard deviation is a parameter, which is a fixed value calculated from every individual in the population. A sample standard deviation is a statistic, which means that it is calculated from only some of the individuals in a population. Since the sample standard deviation depends upon the sample, it has greater variability. Thus, the standard deviation of the sample is greater than that of the population.

If $y=f(x)$:

Standard deviation for a population is calculated as follows:

$$stddev(y) = \sqrt{\frac{\sum_{i=1}^N (y_i - average(y))^2}{N}}$$

Standard deviation for a sample is calculated as follows:

$$stddev(y) = \sqrt{\frac{\sum_{i=1}^N (y_i - average(y))^2}{N-1}}$$

Where N is the total number of data points.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<code>o_waveform</code>	Waveform object or family of waveforms representing simulation results that can be displayed as a series of points. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code>)
<code>?overall g_overall</code>	<p>Specifies whether to calculate the overall average across corners and sweeps. Possible values are <code>t</code> and <code>nil</code>.</p> <ul style="list-style-type: none">■ When the <code>overall</code> argument is set to <code>t</code>, the average is calculated across all corners and sweeps.■ When the <code>overall</code> argument is set to <code>nil</code>, the average is calculated per leaf. <p>The default value is <code>t</code>.</p>
<code>?type t_type</code>	<p>Specifies whether to calculate the standard deviation for a population or for a sample.</p> <p>Possible values are <code>population</code> and <code>sample</code>. The default value is <code>population</code>.</p>
<code>?continuous g_continuous</code>	<p>Specifies whether to calculate the average amplitude of the input waveform by considering it as a continuous signal or as a discrete signal. Possible values are:</p> <ul style="list-style-type: none">■ <code>t</code>: The waveform is considered as a continuous signal.■ <code>nil</code>: The waveform is considered as a discrete signal. <p>The default value is <code>t</code>.</p>

Value Returned

<code>n_stddev</code>	Returns a number representing the standard deviation value of the input waveform.
<code>o_waveformStddev</code>	Returns a waveform representing the average value if the input is a family of waveforms.
<code>nil</code>	Returns <code>nil</code> or an error message.

Example

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Returns the population standard deviation of the voltage (y-axis value) of /OUT by considering it as a continuous signal.

```
stddev(VS("/OUT") ?type "population" ?continuous t )  
=>314.4e-6
```

Returns the sample standard deviation of the voltage (y-axis value) of /OUT by considering it as a discrete signal.

```
stddev(VS("/OUT") ?type "sample" ?continuous nil )  
=>329.9e-6
```


tangent

```
tangent (
    o_waveform
    [ ?x n_x ]
    [ ?y n_y ]
    [ ?slope n_slope ]
    [ ?ckm ckm ]
)
=> o_waveform / nil
```

Description

Returns the tangent to a waveform through the point (n_x , n_y) with the given slope.

Arguments

<i>o_waveform</i>	Waveform object representing the wave.
?x <i>n_x</i>	X coordinate of the point. The default value is the X coordinate of the first point on the wave.
?y <i>n_y</i>	Y coordinate of the point. The default value is the Y coordinate at the given or default X coordinate.
?slope <i>n_slope</i>	Slope of the line. Default value: 1.0
?ckm <i>ckm</i>	

Value Returned

<i>o_waveform</i>	Wave object representing the line.
nil	Returns nil if there is an error.

Example

```
refLine
=> tangent(refWave ?x -25 ?slope 1.0)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

thd

```
thd(  
    o_waveform  
    n_from  
    n_to  
    x_num  
    n_fund  
)  
=> o_waveform / n_thdValue / nil
```

Description

The thd function computes the percentage of total harmonic content of a signal with respect to the fundamental frequency expressed as a voltage percentage.

The computation uses the dft function. Assume that the *dft* function returns complex coefficients $A_0, A_1, \dots, A_f, \dots$. Please note that fundamental frequency ***f is the frequency contributing to the largest power in the signal.*** A_0 is the complex coefficient for the DC component and A_i is the complex coefficient for the *i*th harmonic where $i \neq 0, f$. Then, total harmonic distortion is computed as:

$$\frac{\sqrt{\sum_{i=1, i \neq 0, f} |A_i|^2}}{|A_f|} \times 100 \%$$

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>n_from</i>	Starting time for the DFT sample window.
<i>n_to</i>	Ending time for the DFT sample window.
<i>x_num</i>	Number of timepoints.
<i>n_fund</i>	Fundamental Frequency of the signal. If it is nil or zero then the non-zero frequency contributing to the largest power in the signal is used as the fundamental frequency. Otherwise, the harmonic frequency nearest to its value is used as the fundamental frequency.

Value Returned

<i>o_waveform</i>	Returns a waveform representing the absolute value of the total harmonic distortion if the input argument is a family of waveforms.
<i>n_thdValue</i>	Returns the absolute value of the total harmonic distortion of the input waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
plot( thd( v( "/net8" ) 10u 20m 64 0 ) )
```

Computes the absolute value of the total harmonic distortion for the waveform representing the voltage of "/net8". The computation is done from 10u to 20m with 64 time points using the non-zero frequency contributing to the largest power in the signal as the fundamental frequency. The resulting waveform is plotted.

```
plot( thd( v( "/net8" ) 10u 20m 64 90 ) )
```

Computes the absolute value of the total harmonic distortion for the waveform representing the voltage of "/net8". The computation is done from 10u to 20m with 64 timepoints using a harmonic frequency, whose absolute difference w.r.t 90 is minimum, as the fundamental frequency. The resulting waveform is plotted.

thd_fd

```
thd_fd(  
    t_name  
    t_result  
)  
=> n_thdValue / nil
```

Description

The thd_fd function returns the total harmonic distortion of the input waveform.

Arguments

<i>t_name</i>	Name of the node for which total harmonic distorted is to be computed.
<i>t_result</i>	Name of the result of the specified node.

Value Returned

<i>n_thdValue</i>	Return a value of total harmonic distortion of the input waveform.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
thd_fd( "Plo" ?result "FOUR0-tran.test_fourier" )
```

Computes the total harmonic distortion for the "FOUR0-tran.test_fourier" dataset in the results, where Fourier is connected to node "Plo".

unityGainFreq

```
unityGainFreq(  
    o_gainFreqWaveform  
)  
=> n_frequency / nil
```

Description

Computes and reports the frequency at which the gain is unity.

Arguments

o_gainFreqWaveform Gain frequency waveform.
m

Value Returned

<i>n_frequency</i>	Returns a scalar value representing the frequency at which the gain of the input waveform is unity.
<i>nil</i>	Returns <i>nil</i> otherwise.

Example

```
unityGainFrequency( VF("/out") )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

value

```
value(  
    o_waveform  
    [ ?scale scale ]  
    [ ?period n_period ]  
    [ ?xName s_xName]  
    [ ?histoDisplay g_histoDisplay ]  
    [ ?noOfHistoBins x_noOfHistoBins ]  
    @Rest args  
)  
=> o_waveform / g_value / nil
```

Description

Returns the Y value of a waveform for a given X value.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>?scale scale</i>	<p>Specifies the interpolation scale for WREAL signals. Valid values: <code>linear</code>, <code>log</code>, <code>nil</code>. Note that all scale elements after the second element are ignored.</p> <ul style="list-style-type: none">■ X is interpolated in linear mode if <code>scale=nil</code> or the first element of <code>scale</code> is <code>linear</code>.■ X is interpolated in log mode if the first element of <code>scale</code> is <code>log</code>.■ Y is interpolated in linear mode if <code>scale</code> has a single element <code>linear</code> or second element is <code>linear</code>.■ Y is interpolated in log mode if <code>scale</code> has a single element <code>log</code>, or second element is <code>log</code>.
<i>s_name</i>	The name of the innermost or outermost sweep variable. If the sweep variable name is not supplied, the innermost sweep variable is used.
<i>g_value</i>	Value (X value) at which to provide the Y value. If a string has been defined for a value or set of values, the string may be used instead of the value.
<i>?period n_period</i>	The interval or period after which the value needs to be computed.
<i>g_multiple</i>	An optional boolean argument that takes the value <code>nil</code> by default. If set to <code>t</code> , the function returns multiple occurrences of the interpolated value.
<i>?xName s_xName</i>	<p>An optional argument that is used only when <i>g_multiple</i> is set to <code>t</code>. It takes the value <code>time</code> by default. It controls the contents of the x vector of the waveform object returned by the function.</p> <p>Valid values: <code>time</code>, <code>cycle</code></p>
<i>?histoDisplay g_histoDisplay</i>	

OCEAN Reference

Predefined and Waveform (Calculator) Functions

When set to `t`, returns a waveform that represents the statistical distribution of the `riseTime` data in the form of a histogram. The height of the bars (bins) in the histogram represents the frequency of the occurrence of values within the range of `riseTime` data.

Valid values: `t nil`

Default value: `nil`

`?noOfHistoBins` *x_noOfHistoBins*

Denotes the number of bins represented in the histogram representation.

Valid values: Any positive integer

Default value: `1`

`@Rest` *args*

Note: `g_histoDisplay` and `x_noOfHistoBins` are added for backward compatibility only. It will be deprecated in future releases. Use the `histo` function for plotting the histogram of the resulting function.

For the simplest calls to the function, which specify only the given waveform (*o_waveform*) and the X value (*g_value*), the given waveform can be a family of waveforms. If the family is of dimension *m*, *g_value* can be either of dimension *m-1* or a scalar. If *g_value* is scalar, the function returns the Y value of all the components of the family at the specified *g_value*.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Value Returned

<i>o_waveform</i>	Returns a waveform or a family of waveforms if the input argument is a family of waveforms or if values are expected at multiple points.
<i>g_value</i>	Returns the Y value if the input argument is a single waveform. For parametric sweeps, the value might be a waveform that can be printed with the <code>ocnPrint</code> command.
<i>nil</i>	Returns <code>nil</code> and an error message if the value cannot be printed.

Example

```
value( v( "/net18" ) 4.428e-05 )
```

Prints the value of `"/net18"` at `time=4.428e-05`. This is a parametric sweep of temperature over time.

```
value( v( "/OUT" ) 'TEMPDC 20.0 )
```

Returns `srrWave:XXXXX`, indicating that the result is a waveform.

```
print( value( v( "/OUT" ) 'TEMPDC 20.0 ) )
```

Prints the value of `v("/OUT")` at every time point for `TEMPDC=20`.

```
print( value( v( "/OUT" ) 200n ?period 100n ) )
```

Prints the value of `v("/OUT")` at `200n`, `300n` and so on at intervals of `100n` until the end of the waveform.

```
value(VT("/out") 2e-07 ?period 2e-07 ?xName "time") (V)
```

Returns multiple occurrences of the value specified against time-points at which each interpolated value occurs.

```
value(VT("/out") 2e-07 ?period 2e-07 ?xName "cycle") (V)
```

Returns multiple occurrences of value specified against cycle numbers, where a cycle number refers to the *n*'th occurrence of the value event in the input waveform.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

xmax

```
xmax (
    o_waveform
    x_numberOfPeaks
)
=> o_waveform / g_value / l_value / nil
```

Description

Computes the value of the independent variable (X) at which the Y value attains its maximum value.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>x_numberOfPeaks</i>	Specifies the <i>n</i> th X value corresponding to the maximum Y value. For example, if <i>x_numberOfPeaks</i> is 3, the X value corresponding to the third maximum Y value is returned. If you specify a negative integer for <i>x_numberOfPeaks</i> , the X values are counted from right to left (from maximum to minimum). If <i>x_numberOfPeaks</i> is 0, <code>xmax</code> returns a list of X locations.

Value Returned

<i>o_waveform</i>	Returns a waveform (or a family of waveforms) if the input argument is a family of waveforms.
<i>g_value</i>	Returns the X value corresponding to the peak specified with <i>x_numberOfPeaks</i> if the input argument is a single waveform.
<i>l_value</i>	Returns a list of X locations when <i>x_numberOfPeaks</i> is 0 and the input argument is a single waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
xmax( v( "/net9" ) 1 )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Gets the time value (X-axis value) at which the voltage of `"/net9"` attains its first peak value.

```
xmax( v( "/net9" ) 0 )
```

Gets the list of time values (X-axis values) at which the voltage of `"/net9"` attains each of its peak values.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

xmin

```
xmin(  
    o_waveform  
    x_numberOfValleys  
)  
=> o_waveform / g_value / l_value / nil
```

Description

Computes the value of the independent variable (X) at which the Y value attains its minimum value.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
<i>x_numberOfValleys</i>	Specifies the <i>n</i> th X value corresponding to the minimum Y value. For example, if <i>x_numberOfValleys</i> is 3, the X value corresponding to the third minimum Y value is returned. If you specify a negative integer for <i>x_numberOfValleys</i> , the X-values are counted from right to left (from maximum to minimum). If <i>x_numberOfValleys</i> is 0, <code>xmin</code> returns a list of X locations.

Value Returned

<i>o_waveform</i>	Returns a waveform (or a family of waveforms) if the input argument is a family of waveforms.
<i>g_value</i>	Returns the X value corresponding to the valley specified with <i>x_numberOfValleys</i> if the input argument is a single waveform.
<i>l_value</i>	Returns a list of X locations when <i>x_numberOfValleys</i> is 0 and the input argument is a single waveform.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
xmin( v( "/net9" ) 1 )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Gets the time value (X axis) at which the voltage of `"/net9"` has its first low point or valley.

```
xmin( v( "/net9" ) 0 )
```

Gets the list of time values (X axis) at which the voltage of `"/net9"` has low points or valleys.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

xval

```
xval(  
    o_waveform  
)  
=> o_waveform / nil
```

Description

Returns a waveform whose X vector and Y vector are equal to the input waveform's X vector.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

Value Returned

<i>o_waveform</i>	Returns a waveform if the input argument is a single waveform. Returns a family of waveforms if the input argument is a family of waveforms.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
xval( v( "/net8" ) )
```

Returns a waveform in which the X vector for the voltage of `"/net8"` is also used for the Y vector.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

ymax

```
ymax (
    o_waveform
    [ ?overall overall ]
)
=> n_max / o_waveformMax / nil
```

Description

Computes the maximum value of the waveform's Y vector.

A waveform consists of an independent-variable X vector and a corresponding Y vector.

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

<i>?overall overall</i>	
-------------------------	--

Value Returned

<i>n_max</i>	Returns a number representing the maximum value of Y if the input argument is a single waveform.
--------------	--

<i>o_waveformMax</i>	Returns a waveform (or family of waveforms) representing the maximum value of Y if the input argument is a family of waveforms.
----------------------	---

<i>nil</i>	Returns <code>nil</code> and an error message otherwise.
------------	--

Example

```
ymax( v( "/net9" ) )
```

Gets the maximum voltage (Y value) of `"/net9"`.

ymin

```
ymin(  
    o_waveform  
    [ ?overall overall ]  
)  
=> n_min / o_waveformMin / nil
```

Description

Computes the minimum value of a waveform's Y vector.

(A waveform consists of an independent-variable X vector and a corresponding Y vector.)

Arguments

<i>o_waveform</i>	Waveform object representing simulation results that can be displayed as a series of points on a grid. (A waveform object identifier looks like this: <code>srrWave:XXXXX</code> .)
-------------------	---

?overall overall

Value Returned

<i>n_min</i>	Returns a number representing the minimum value of Y if the input argument is a single waveform.
<i>o_waveformMin</i>	Returns a waveform (or family of waveforms) representing the minimum value of Y if the input argument is a family of waveforms.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
ymin( v( "/net9" ) )
```

Gets the minimum voltage (Y value) of `"/net9"`.

Spectre RF and S-Parameter Calculator Functions

This section describes the following calculator functions used for Spectre RF data analysis:

- ifreq
- ih
- itime
- pir
- pmNoise
- pn
- pvi
- pvr
- spm
- totalNoise
- vfreq
- vfreqterm
- vh
- vhterm
- vtime
- vtimeterm
- ypm
- zpm

OCEAN Reference

Predefined and Waveform (Calculator) Functions

ifreq

```
ifreq(  
    s_ana  
    t_terminal  
    [ freq n_freq ]  
)  
=> o_waveform / nil
```

Description

Returns the current of the terminal at a specified frequency or at all frequencies in the frequency domain.

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are hb, pss, qpss, pac, hbac, qpac, and ac. Default value: hb
<i>t_terminal</i>	Terminal name on the schematic or signal name from the Results Browser.
<i>n_freq</i>	Frequency for which you want to plot the results. It is an optional field. Valid values: Any integer or floating point number. Default value: nil When you specify nil, current on all the frequency points are returned.

Value Returned

<i>o_waveform</i>	Returns a waveform representing current at a specified frequency or at all frequency points.
nil	Returns nil and an error message otherwise.

Example

```
ifreq("hb" "/load/PLUS" 50 )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Returns the current for `/load/PLUS` signal, which is obtained from `hb` analysis, at `frequency=50`.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

ih

```
ih(  
    s_ana  
    t_terminal  
    [ x_hlist ]  
)  
=> o_waveform / nil
```

Description

Returns the current of the terminal at a specified harmonic or at all harmonics in the frequency domain.

Arguments

s_ana

Type of analysis.

Valid values are:

- *hb*: Harmonic Balance analysis. This is the default value.
- *pss*: Periodic Steady-State analysis.
- *qpss*: Quasi-Periodic Steady-State analysis
- *pac*: Periodic AC analysis
- *hbac*: Harmonic Balance AC analysis
- *qpac*: Quasi-Periodic AC analysis

t_terminal

Terminal name on the schematic or the signal name in the Results Browser.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

x_hlist Single harmonic or a list of harmonics for which you want to plot the current of the terminal.

This is an optional argument. You can specify a single harmonic or a list from the available list of harmonics. If a single harmonic is specified, the function returns the current at that harmonic. If a list of harmonics is specified, the function returns a waveform with the harmonics at each of the chosen harmonics.

You can find the available list of harmonics for each analysis by using the `harmonicList` function.

```
harmonicList( [?resultsDir t_resultsDir]  
[?result S_resultName]
```

In a single-tone simulation, each harmonic is described using an integer. In a multi-tone simulation, each harmonic is described using a list of integers, with one integer for each tone.

The default value is `nil`, which indicates that the current of the terminal is calculated for all harmonics.

Value Returned

o_waveform Returns a waveform representing current at a specified harmonic or at all harmonic points.

`nil` Returns `nil` and an error message otherwise.

Examples

The following example returns a list of available harmonics for the specified results. In this example, two tones are simulated in the `hb` simulation, and therefore the harmonic list is a list of two-element indices.

```
harmonicList(?resultsDir "./simulation/ExampleLibRF/db_mixer/maestro/results/  
maestro/ExplorerRun.0/1/ExampleLibRF_db_mixer_1/psf" ?result 'hb_mt_fi)  
=> ((-5 5) (-4 4) (-4 5) (-3 3) (-3 4) (-3 5) (-2 2) (-2 3) (-2 4) (-2 5) (-1 1)  
(-1 2) (-1 3) (-1 4) (-1 5) (0 0) (0 1) (0 2) (0 3) (0 4) (0 5) (1 0) (1 1) (1 2)  
(1 3) (1 4) (1 5) (2 -1) (2 0) (2 1) (2 2) (2 3) (2 4) (2 5) (3 -2) (3 -1) (3 0)  
(3 1) (3 2) (3 3) (3 4) (3 5) (4 -3) (4 -2) (4 -1) (4 0) (4 1) (4 2) (4 3) (4 4)  
(4 5) (5 -4) (5 -3) (5 -2) (5 -1) (5 0) (5 1) (5 2) (5 3) (5 4) (5 5) (6 -5) (6 -  
4) (6 -3) (6 -2) (6 -1) (6 0) (6 1) (6 2) (6 3) (6 4) (6 5))
```

To calculate the current of the terminal `/rf/PLUS` for the harmonic `(0 2)`, that is 0 times one tone plus 2 times the other tone in `hb` analysis, specify the following:

```
ih("hb" "/rf/PLUS" '(0 2) )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

```
=> srrWave:0x3d70db20
```

This returns a waveform representing the current of the terminal `/rf/PLUS` at the specified harmonic `(0 2)`.

If you want to plot the current at different harmonic combinations, you can specify the list of harmonics. For example: `'((0 2) (0 3) (0 4))`.

The following example returns a waveform that represents the current of the terminal `/rf/PLUS` at different harmonic combinations.

```
ih("hb" "/rf/PLUS" '((0 2) (0 3) (0 4)))  
=> srrWave:0x3d70b470
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

itime

```
itime(  
    s_ana  
    t_terminal  
    [ time n_time ]  
)  
=> o_waveform / nil
```

Description

Returns the current of the terminal at a specified time point or at all time points in the time domain.

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are <code>hb</code> , <code>pss</code> , and <code>tran</code> . Default value: <code>hb</code>
<i>t_terminal</i>	Terminal name on the schematic or signal name from the Results Browser.
<i>n_time</i>	Time points for which you want to plot the results. If you specify a time point in this field, the result of the specified time is returned. It is an optional field. Valid values: Any integer or floating point number. Default value: <code>nil</code> .

Value Returned

<i>o_waveform</i>	Returns a waveform representing current at a specified time point or at all time points.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
itime("hb" "/load/PLUS" 4 )
```

Returns the current for `/load/PLUS` signal, which is obtained from `hb` analysis, at time=4s.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

pir

```
pir(  
    s_ana  
    t_branch1  
    t_branch2  
    n_resistance  
    [ harmonic x_hlist ]  
)  
=> o_waveform / nil
```

Description

Returns the spectral power from current and resistance for a specified harmonic list or for all harmonic points.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are <code>hb</code> , <code>pss</code> , <code>qpss</code> , <code>pac</code> , <code>hbac</code> and <code>qpac</code> . Default value: <code>hb</code>
<i>t_branch1</i>	First branch name on the schematic or signal name from the Results Browser.
<i>t_branch2</i>	Second branch name on the schematic or signal name from the Results Browser.
<i>n_resistance</i>	The resistance value. Valid values: Any integer or floating point number.
<i>harmonic x_hlist</i>	Harmonics for which you want to plot the results. It is an optional field. For analyses, such as <code>hb</code> , <code>pss</code> , <code>pac</code> , and <code>hbac</code> , you can add either single harmonic value or an available list of harmonic values in this field. Valid values: Any integer or a list from the available list of harmonics. You can find the available harmonics by using the harmonicList function. Default value: <code>nil</code> .

Value Returned

<i>o_waveform</i>	Returns a waveform representing spectral power from current and resistance for a specified harmonic list.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
pir("hb" "/V1/PLUS" "/rf/PLUS" 2 5 )
```

This example returns the spectral power for `/V1/PLUS` and `/rf/PLUS`, which are obtained from the `hb` analysis, at `resistance=2 ohms` and `harmonic=5`.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

pmNoise

```
pmNoise(  
    s_ana  
    [ freq n_freq ]  
    s_modifier  
    g_dsb  
    )  
=> o_waveform / n_pnoise / nil
```

Description

Returns the modulated phase noise at a specified frequency or for the entire spectrum.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>s_ana</i>	Analysis type or analysis name. Valid values: <code>pnoise</code> , and <code>hbnoise</code> . Default value: <code>pnoise</code>
<i>n_freq</i>	Frequency for which you want to calculate the modulated phase noise. Valid values: Any integer or floatng point number Default value: <code>nil</code> , which means the frequency at all points are calculated.
<i>s_modifier</i>	Modifier to be used. Valid values: <code>dBc</code> , <code>normalized</code> , <code>Power</code> , <code>Magnitude</code> , and <code>dBV</code> Default value: <code>dBc</code> .
<i>g_dsb</i>	Specifies whether you want to include the double side band. Valid values: <code>t</code> and <code>nil</code> Default value: <code>t</code>

Value Returned

<i>n_pnoise</i>	Returns the modulated phase noise at the specified frequency point.
<i>o_waveform</i>	Returns a waveform representing the modulated phase noise at all frequency points.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
pmNoise("hbnoise" 50 "dBc" t )
```

This example returns the modulated phase noise for `hbnoise` analysis at frequency=50 and modifier=`dBc` and double side bands included.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

pn

```
pn(  
    s_ana  
    [ freq n_freq ]  
    )  
=> o_waveform / n_pn / nil
```

Description

Returns the phase noise at a specified frequency or at all frequency points.

Arguments

<i>s_ana</i>	Analysis type or analysis name. Valid values: <code>pnoise</code> , <code>hbnoise</code> , and <code>qpnoise</code> . Default value: <code>pnoise</code>
<i>n_freq</i>	Frequency for which you want to calculate the phase noise. Valid values: Any integer or floating point number Default value: <code>nil</code> , which means the frequency at all points are calculated.

Value Returned

<i>n_pn</i>	Returns the phase noise at a specified frequency point.
<i>o_waveform</i>	Returns a waveform representing the phase noise at all frequency points.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
pn("hbnoise" 50 )
```

This example returns the phase noise for `hbnoise` analysis at frequency=50.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

pvi

```
pvi(  
    s_ana  
    t_pos  
    t_neg  
    t_branch1  
    t_branch2  
    [ harmonic x_hlist ]  
)  
=> o_waveform / nil
```

Description

Returns the spectral power from voltage and current for a specified harmonic list or for all harmonics.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are <code>hb</code> , <code>pss</code> , <code>qpss</code> , <code>pac</code> , <code>hbac</code> and <code>qpac</code> . Default value: <code>hb</code>
<i>t_pos</i>	Positive node or net from the schematic or from the Results Browser. This field can also contain an explicit voltage value.
<i>t_neg</i>	Negative node or net from the schematic or from the Results Browser. This field can also contain an explicit voltage value.
<i>t_branch1</i>	First branch name on the schematic or signal name from the Results Browser.
<i>t_branch2</i>	Second branch name on the schematic or signal name from the Results Browser.
<i>x_hlist</i>	Harmonics for which you want to plot the results. It is an optional field. For analyses, such as <code>hb</code> , <code>pss</code> , <code>pac</code> , and <code>hbac</code> , you can add either single harmonic value or available list of harmonic values in this field. Valid values: Any integer or a list from the available list of harmonics. You can find the available harmonics by using the harmonicList function. Default value: <code>nil</code>

Value Returned

<i>o_waveform</i>	Returns a waveform representing the spectral power from voltage and current for a specified harmonic list or for all harmonics.
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
pvi("hb" "/RFin" "/RFout" "/V1/PLUS" "/V2/PLUS" 2)
```

This example returns the spectral power for the following values:

- *Analysis Type* is `hb`
- *Positive node* is `/RFin`
- *Negative node* is `/RFout`

OCEAN Reference

Predefined and Waveform (Calculator) Functions

- *Branch name 1* /V1/PLUS
- *Branch name 2* /V2/PLUS
- *Harmonic List* is 2

OCEAN Reference

Predefined and Waveform (Calculator) Functions

pvr

```
pvr (
    s_ana
    t_pos
    t_neg
    n_resistance
    [ harmonic x_hlist ]
)
=> o_waveform / nil
```

Description

Returns the spectral power at a specified harmonic list or at all harmonics with resistor and voltage on the positive and negative nodes.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are <code>hb</code> , <code>pss</code> , <code>qpss</code> , <code>pac</code> , <code>hbac</code> and <code>qpac</code> . Default value: <code>hb</code>
<i>t_pos</i>	Positive node or net from the schematic or from the Results Browser. This field can also contain an explicit voltage value.
<i>t_neg</i>	Negative node or net from the schematic or from the Results Browser. This field can also contain an explicit voltage value.
<i>n_resistance</i>	The resistance value. Valid values: Any integer or floating point number
<i>x_hlist</i>	Specify the harmonics for which you want to plot the results. It is an optional field. For analyses, such as <code>hb</code> , <code>pss</code> , <code>pac</code> , and <code>hbac</code> , you can add either single harmonic value or available list of harmonic values in this field. Valid values: Any integer or a list from the available list of harmonics. You can find the available harmonics by using the harmonicList function. Default value: <code>nil</code> .

Value Returned

<i>o_waveform</i>	Returns a waveform representing the spectral power on specified harmonic list or on all harmonics with resistor and voltage on the positive and negative nodes
<i>nil</i>	Returns <code>nil</code> and an error message otherwise.

Example

```
pvr("hb" "/RFin" "/RFout" 2 2 )
```

This example returns the spectral power for the following values:

- *Analysis Type* is `hb`
- *Positive node* is `/RFin`
- *Negative node* is `/RFout`
- *Resistance* is `2`

OCEAN Reference

Predefined and Waveform (Calculator) Functions

- *Harmonic List* is 2

OCEAN Reference

Predefined and Waveform (Calculator) Functions

spm

```
spm (  
    s_ana  
    x_index1  
    x_index2  
    [ ?port1 x_port1 ]  
    [ ?port2 x_port2 ]  
)  
=> o_waveform / nil
```

Description

Returns the waveform for s-parameters.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Arguments

<i>s_ana</i>	Analysis type or analysis name. Valid values: <i>sp</i> , <i>psp</i> , <i>qpssp</i> , and <i>hbsp</i> Default value: <i>sp</i>
<i>x_index1</i>	Port index for <i>sp</i> simulation. By default, this field is set to blank. Valid values: Available port index, such as 1, 2.
<i>x_index1</i>	Port index for <i>sp</i> simulation. By default, this field is set to blank. Valid values: Available port index, such as 1, 2.
<i>?port1 x_port1</i>	Port instance. The port instance can be specified only for the differential s-parameter analysis and not applicable for <i>psp</i> , <i>qpssp</i> and <i>hbsp</i> analyses. Valid values: Predefined values “c” and “d” for Spectre simulator.
<i>?port2 x_port2</i>	Port instance. The port instance can be specified only for the differential s-parameter analysis and not applicable for <i>psp</i> , <i>qpssp</i> and <i>hbsp</i> analyses. Valid values: Predefined values “c” and “d” for Spectre simulator.

Value Returned

<i>o_waveform</i>	Returns a waveform representing the s-parameters.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
spm("sp" 1 1 ?port1 nil ?port2 nil)
```

This example plots the s-parameter waveform for *sp* analysis with *index1*=1 and *index 2*=1.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

totalNoise

```
totalNoise(  
    s_ana  
    n_sfreq  
    n_efreq  
    [ instances l_instances ]  
)  
=> n_totalNoise / nil
```

Description

Returns the total noise in a specified frequency limit.

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are <code>noise</code> , <code>pnoise</code> , <code>qpnoise</code> , and <code>hbnoise</code> . Default value: <code>noise</code> .
<i>n_sfreq</i>	The start frequency. Valid values: Any integer or floating point number
<i>n_efreq</i>	The end frequency. Valid values: Any integer or floating point number
<i>l_instances</i>	List of instances or instance names. The noise contributed by the instances specified in this field is ignored while calculating the total noise. This is an optional field.

Value Returned

<i>n_totalNoise</i>	Returns the total noise in a specified frequency limit.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Example

```
totalNoise("hbnoise" 1k 100k out )
```

This example returns the total noise for `hbnoise` analysis in the frequency range 1k to 100k with instance `out` being excluded.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

vfreq

```
vfreq(  
    s_ana  
    t_net  
    [ freq x_freq ]  
)  
=> o_waveform / nil
```

Description

Returns the voltage of a net at a specified frequency or at all frequencies in the frequency domain.

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are hb, pss, qpss, pac, hbac, qpac, and ac. Default value: hb
<i>t_net</i>	Net name from the schematic or signal name from the Results Browser.
<i>x_freq</i>	Frequency for which you want to plot the results. It is an optional field. Valid values: Any integer value Default Value: nil

Value Returned

<i>o_waveform</i>	Returns a waveform representing the voltage of net at a specified frequency
nil	Returns nil and an error message otherwise

Example

```
vfreq("hb" "/outp" 50 )
```

This example returns the voltage of /outp net from hb analysis at frequency=50.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

vfreqterm

```
vfreqterm(  
    s_ana  
    t_terminal  
    [ freq x_freq ]  
)  
=> o_waveform | g_value | nil
```

Description

Returns the voltage of a terminal at a specified frequency or at all frequencies in the frequency domain.

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are <code>ac</code> , <code>pss</code> , <code>hb</code> , <code>pac</code> , <code>hbac</code> , <code>qpss</code> , and <code>qpac</code> . Default value: <code>hb</code>
<i>t_terminal</i>	Terminal name in schematic from the Results Browser.
<i>freq x_freq</i>	Frequency for which you want to plot the results. It is an optional field. Valid value: Any integer value Default value: <code>nil</code>

Value Returned

<i>o_waveform</i>	Returns a waveform representing the voltage at a terminal on the specified frequency.
<i>g_value</i>	Returns the value of voltage at a terminal on the specified frequency.
<i>nil</i>	Returns <code>nil</code> or an error message.

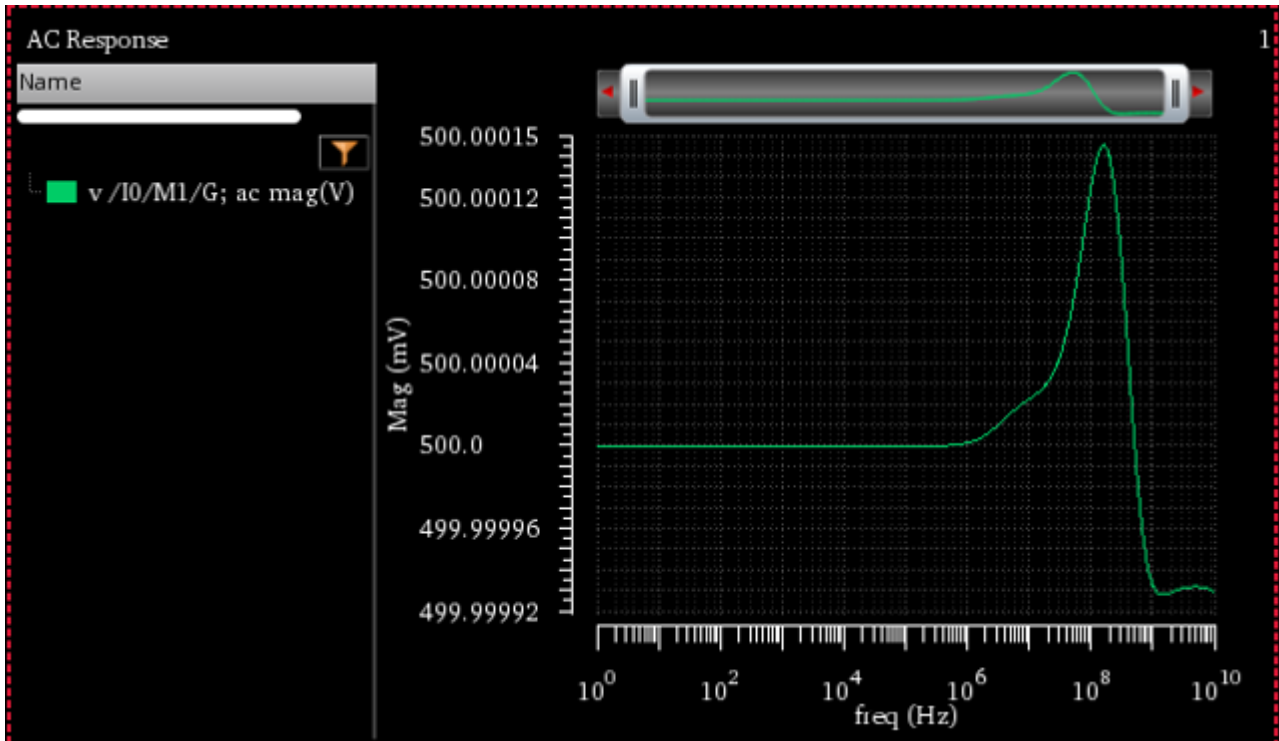
Example

```
vfreqterm( 'ac "/IO/M1/G" )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

It returns the following plot.



OCEAN Reference

Predefined and Waveform (Calculator) Functions

vh

```
vh(  
    s_ana  
    t_net  
    [ x_hlist ]  
)  
=> o_waveform / nil
```

Description

Returns the voltage on a net at a specified harmonic or at all harmonics in the frequency domain.

Arguments

<i>s_ana</i>	Type of analysis. Valid values are: <ul style="list-style-type: none">■ <i>hb</i>: Harmonic Balance analysis. This is the default value.■ <i>pss</i>: Periodic Steady-State analysis.■ <i>qpss</i>: Quasi-Periodic Steady-State analysis■ <i>pac</i>: Periodic AC analysis■ <i>hbac</i>: Harmonic Balance AC analysis■ <i>qpac</i>: Quasi-Periodic AC analysis
<i>t_net</i>	Net name on the schematic or the signal name in the Results Browser.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

x_hlist Single harmonic or a list of harmonics for which you want to plot the voltage of the net.

This is an optional argument. You can specify a single harmonic or a list from the available list of harmonics. If a single harmonic is specified, the function returns the voltage at that harmonic. If a list of harmonics is specified, the function returns a waveform with the harmonics at each of the chosen harmonics.

You can find the available list of harmonics for each analysis by using the `harmonicList` function.

```
harmonicList( [?resultsDir t_resultsDir]  
[?result S_resultName]
```

In a single-tone simulation, each harmonic is described using an integer. In a multi-tone simulation, each harmonic is described using a list of integers, with one integer for each tone.

The default value is `nil`, which indicates that the voltage of the net is calculated for all harmonics.

Value Returned

o_waveform Returns a waveform representing the voltage on a net at a specified harmonic or at all harmonic points.

`nil` Returns `nil` and an error message otherwise.

Example

The following example returns a list of available harmonics for the specified results. In this example, two tones were simulated in the `hb` simulation, and therefore the harmonic list is a list of two-element indices.

```
harmonicList(?resultsDir "./simulation/ExampleLibRF/db_mixer/maestro/results/  
maestro/ExplorerRun.0/1/ExampleLibRF_db_mixer_1/psf" ?result 'hb_mt_fi)  
=> ((-5 5) (-4 4) (-4 5) (-3 3) (-3 4) (-3 5) (-2 2) (-2 3) (-2 4) (-2 5) (-1 1)  
(-1 2) (-1 3) (-1 4) (-1 5) (0 0) (0 1) (0 2) (0 3) (0 4) (0 5) (1 0) (1 1) (1 2)  
(1 3) (1 4) (1 5) (2 -1) (2 0) (2 1) (2 2) (2 3) (2 4) (2 5) (3 -2) (3 -1) (3 0)  
(3 1) (3 2) (3 3) (3 4) (3 5) (4 -3) (4 -2) (4 -1) (4 0) (4 1) (4 2) (4 3) (4 4)  
(4 5) (5 -4) (5 -3) (5 -2) (5 -1) (5 0) (5 1) (5 2) (5 3) (5 4) (5 5) (6 -5) (6 -  
4) (6 -3) (6 -2) (6 -1) (6 0) (6 1) (6 2) (6 3) (6 4) (6 5))
```

To calculate the voltage on the net `/out2` for the harmonic `(0 2)`, that is 0 times one tone plus 2 times the other tone in `hb` analysis, specify the following:

```
vh("hb" "/out2" '(0 2))
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

```
=> srrWave:0x3d70d3f0
```

This returns a waveform representing the voltage on the net `/out2` at the specified harmonic `(0 2)`.

If you want to plot the voltage at different harmonic combinations, you can specify the list of harmonics. For example: `'((0 2) (0 3) (0 4))`.

The following example returns a waveform representing the voltage on the net `/out2` at different harmonic combinations.

```
vh("hb" "/out2" '((0 2) (0 3) (0 4)))  
=> srrWave:0x3d70dd50
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

vhterm

```
vhterm(  
    s_ana  
    t_terminal  
    [ harmonic x_hlist ]  
)  
=> o_waveform | g_value | nil
```

Description

Returns the voltage on a terminal at the specified harmonic or at all the harmonics in the frequency domain.

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are <code>pss</code> , <code>hb</code> , <code>pac</code> , <code>hbac</code> , <code>qpss</code> , and <code>qpac</code> . Default value: <code>hb</code>
<i>t_terminal</i>	Terminal name in schematic from the Results Browser.
<i>harmonic x_hlist</i>	Harmonics for which you want to plot the results. It is an optional field. For analyses, such as <code>hb</code> , <code>pss</code> , <code>pac</code> , and <code>hbac</code> , you can add either single harmonic value or available list of harmonic values in this field. Valid values: Any integer or a list from the available list of harmonics. You can find the available harmonics by using the harmonic list function. Default value: <code>nil</code>

Value Returned

<i>o_waveform</i>	Returns a waveform representing the voltage at a terminal on the specified harmonic.
<i>g_value</i>	Returns the value of voltage at a terminal on the specified harmonic.
<i>nil</i>	Returns <code>nil</code> or an error message.

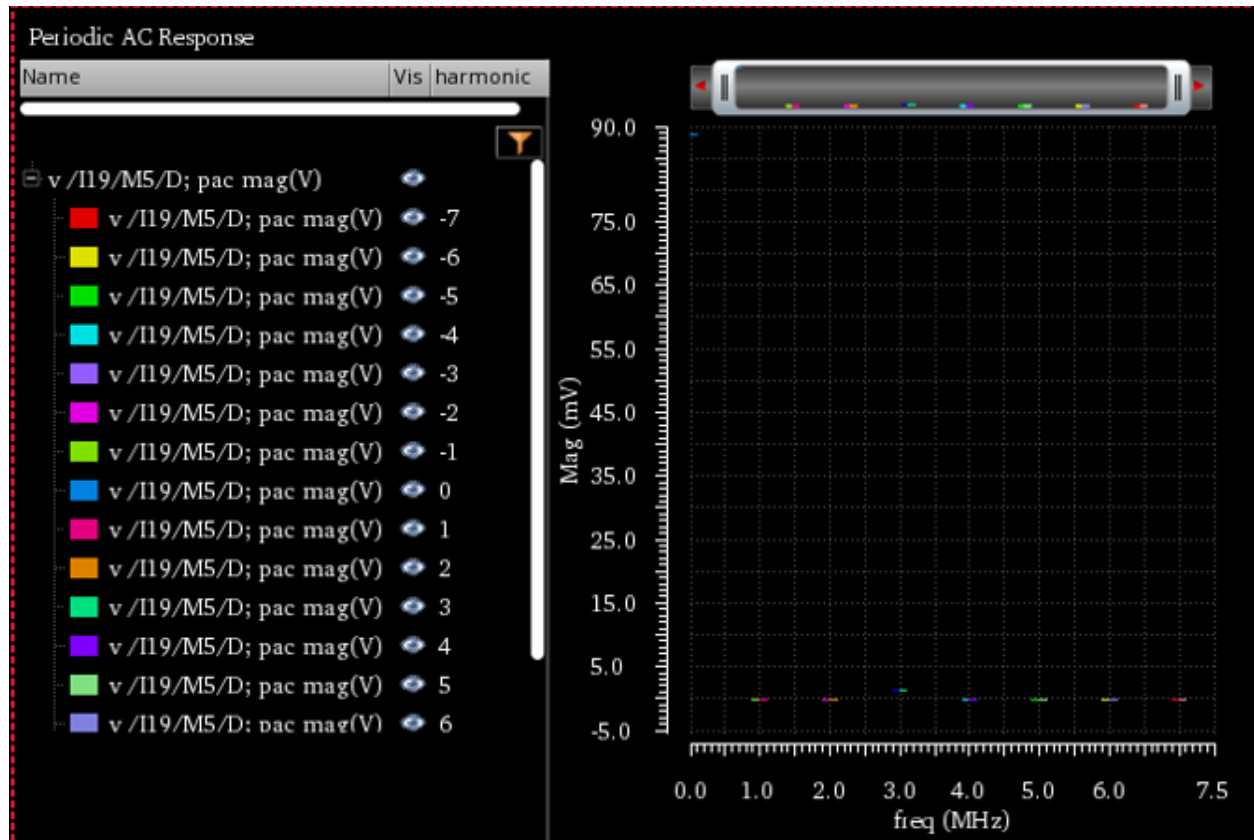
OCEAN Reference

Predefined and Waveform (Calculator) Functions

Example

```
vhterm( 'pac "/I19/M5/D" ' )
```

It returns the following plot.



OCEAN Reference

Predefined and Waveform (Calculator) Functions

vtime

```
vtime(  
    s_ana  
    t_net  
    [ time n_time ]  
)  
=> o_waveform / nil
```

Description

Returns the voltage of a net at a specified time point or at all time points in the time domain.

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are <code>hb</code> , <code>pss</code> , and <code>tran</code> . Default value: <code>hb</code>
<i>t_net</i>	Net name from the schematic or signal name from the Results Browser.
<i>n_time</i>	Time points for which you want to plot the results. If you specify a time point in this field, the result of the specified time is returned. Otherwise, It is an optional field. Valid values: Any integer or floating point number. Default value: <code>nil</code>

Value Returned

<i>o_waveform</i>	Returns a waveform representing the voltage of net at a specified time point
<i>nil</i>	Returns <code>nil</code> and an error message otherwise

Example

```
vtime("hb" "/outm" 20)
```

This example returns the voltage of `/outp` net from `hb` analysis at `time=20s`.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

vtermeterm

```
vtermeterm(  
    s_ana  
    t_terminal  
    [ time n_time ]  
)  
=> o_waveform | g_value | nil
```

Description

Returns the voltage of a terminal at a specified time point or at all time points in the time domain.

Arguments

<i>s_ana</i>	Analysis type or analysis name. The available analyses are <code>tran</code> , <code>pss</code> , and <code>hb</code> . Default value: <code>hb</code>
<i>t_terminal</i>	Terminal name in schematic from the Results Browser.
<i>time n_time</i>	Time points for which you want to plot the results. If you specify a time point in this field, the result of the specified time point is returned. Otherwise, it is an optional field. Valid value: Any integer or floating point number Default value: <code>nil</code>

Value Returned

<i>o_waveform</i>	Returns a waveform representing the voltage at a terminal on the specified time point.
<i>g_value</i>	Returns the value of voltage at a terminal on the specified time point.
<i>nil</i>	Returns <code>nil</code> or an error message.

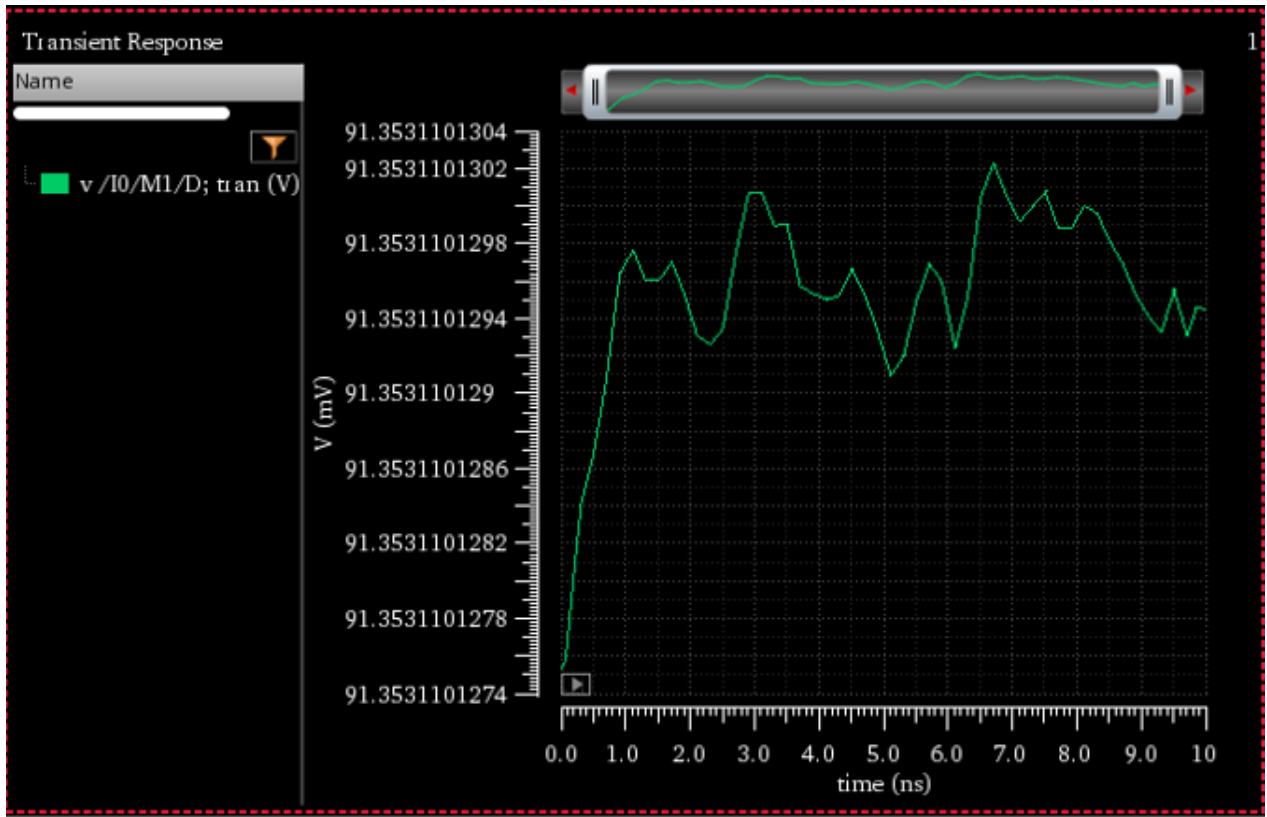
OCEAN Reference

Predefined and Waveform (Calculator) Functions

Example

```
vtimeterm( 'tran "/IO/M1/D" ' )
```

It returns the following plot.



OCEAN Reference

Predefined and Waveform (Calculator) Functions

ypm

```
ypm(  
    s_ana  
    x_index1  
    x_index2  
)  
=> o_waveform / nil
```

Description

Returns the waveform for y-parameters.

Arguments

<i>s_ana</i>	Analysis type or analysis name. Valid values: <i>sp</i> , <i>psp</i> , <i>qpsp</i> , and <i>hbsp</i> Default value: <i>sp</i>
<i>x_index1</i>	Port index for <i>sp</i> simulation. By default, this field is set to blank. Valid values: Available port index, such as 1, 2
<i>x_index2</i>	Port index for <i>sp</i> simulation. By default, this field is set to blank. Valid values: Available port index, such as 1, 2

Value Returned

<i>o_waveform</i>	Returns a waveform representing the y-parameters
<i>nil</i>	Returns <i>nil</i> and an error message otherwise

Example

```
ypm("sp" 1 1)
```

This example returns the waveform for y-parameters when *index1*=1 and *index2*=1.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

zpm

```
zpm (
    s_ana
    x_index1
    x_index2
)
=> o_waveform / nil
```

Description

Returns the waveform for z-parameters.

Arguments

<i>s_ana</i>	Analysis type or analysis name. Valid values: <i>sp</i> , <i>psp</i> , <i>qpssp</i> , and <i>hbsp</i> Default value: <i>sp</i>
<i>x_index1</i>	Port index for <i>sp</i> simulation. By default, this field is set to blank. Valid values: Available port index, such as 1, 2
<i>x_index2</i>	Port index for <i>sp</i> simulation. By default, this field is set to blank. Valid values: Available port index, such as 1, 2

Value Returned

<i>o_waveform</i>	Returns a waveform representing the z-parameters
<i>nil</i>	Returns <i>nil</i> and an error message otherwise

Example

```
zpm("sp" 1 1)
```

This example returns the waveform for z-parameters when *index1*=1 and *index2*=1.

RF Functions in Spectre

This section describes the OCEAN commands for the following RF functions:

- B1f
- gac_freq
- gac_gain
- Gmax
- Gmin
- Gmsg
- GP
- gpc_freq
- gpc_gain
- GT
- Gmux
- Kf
- loadStability
- nc_freq
- nc_gain
- NF
- NFmin
- rn
- sourceStability
- s11
- s12
- s21
- s22

B1f

```
B1f(  
    [ dataDir t_dataDir ]  
)  
=> o_waveform / nil
```

Description

Returns the alternative stability factor in terms of the specified parameters.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object representing the alternative stability factor.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

gac_freq

```
gac_freq(  
    n_gain  
    n_startFreq  
    n_stopFreq  
    n_step  
    [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the available power gain circles where the gain is fixed and frequency is swept.

Arguments

<i>n_gain</i>	Gain value in dB.
<i>n_startFreq</i>	Starting frequency.
<i>n_stopFreq</i>	Ending frequency.
<i>n_step</i>	Frequency step size to be used.
<i>?resultsDir</i> <i>t_resultsDir</i>	Results directory path.

Values Returned

<i>o_waveform</i>	Waveform object.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
gac_freq(16 2G 3G 100M)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

gac_gain

```
gac_gain(  
    n_freq  
    n_startGain  
    n_stopGain  
    n_step  
    [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the available power gain circles where the frequency is fixed and gain is swept.

Arguments

<i>n_freq</i>	Frequency in Hz.
<i>n_startGain</i>	Starting gain value.
<i>n_stopGain</i>	End gain value.
<i>n_step</i>	Gain step size to be used.
?resultsDir <i>t_resultsDir</i>	Results directory path.

Values Returned

<i>o_waveform</i>	Waveform object.
nil	Returns nil and an error message otherwise.

Example

```
gac_gain(2.4G 14 18 0.5)
```

Gmax

```
Gmax(  
  [ dataDir t_dataDir ]  
)  
=> o_waveform / nil
```

Description

Returns the maximum available gain for a two port.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Gmin

```
Gmin(  
  [ dataDir t_dataDir ]  
)  
=> o_waveform / nil
```

Description

Returns the optimum noise reflection coefficient for NFmin.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Gmsg

```
Gmsg(  
    [ dataDir t_dataDir ]  
)  
=> o_waveform / nil
```

Description

Returns the maximum stable power gain for a two port.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

GP

```
GP (
  [ dataDir t_dataDir ]
)
=> o_waveform / nil
```

Description

Returns the power gain. Operating power gain, GP , is defined as the ratio between the power delivered to the load and the power input to the network.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object representing the power gain.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

gpc_freq

```
gpc_freq(  
    n_gain  
    n_startFreq  
    n_stopFreq  
    n_step  
    [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the operating power gain circles where the gain is fixed and frequency is swept.

Arguments

<i>n_gain</i>	Gain value in dB.
<i>n_startFreq</i>	Starting frequency.
<i>n_stopFreq</i>	Ending frequency.
<i>n_step</i>	Frequency step size to be used.
<i>?resultsDir</i> <i>t_resultsDir</i>	Results directory path.

Values Returned

<i>o_waveform</i>	Waveform object.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
gpc_freq(16 2.4G 2.5G 10M)
```

gpc_gain

```
gpc_gain(  
    n_freq  
    n_start  
    n_stop  
    n_step  
    [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the operating power gain circles where the frequency is fixed and gain is swept.

Arguments

<i>n_freq</i>	Frequency value in Hz.
<i>n_start</i>	Starting gain value.
<i>n_stop</i>	Ending gain value.
<i>n_step</i>	Gain step size to be used.
?resultsDir <i>t_resultsDir</i>	Results directory path.

Values Returned

<i>o_waveform</i>	Waveform object.
nil	Returns nil and an error message otherwise.

Example

```
gpc_gain(2.4G 14 18 0.5)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

GT

```
GT(  
    [ dataDir t_dataDir ]  
)  
=> o_waveform / nil
```

Description

Returns the transducer gain. Transducer power gain, GT , is defined as the ratio between the power delivered to the load and the power available from the source.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

Gmux

```
Gmux(  
  [ dataDir t_dataDir ]  
)  
=> o_waveform / nil
```

Description

Returns the maximum unilateral power gain for a two port.

Maximum unilateral transducer power gain, *G_{mx}*, is the transducer power gain when *S₁₂* is zero, and the source and load impedances conjugate are matching.

Arguments

dataDir t_dataDir Results directory path.

Values Returned

<i>o_waveform</i>	Waveform object.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

Kf

```
Kf(  
    [ dataDir t_dataDir ]  
)  
=> o_waveform / nil
```

Description

Returns the Stern stability factor.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

loadStability

```
loadStability(  
    n_startFreq  
    n_stopFreq  
    n_step  
    [ ?resultsDir x_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Computes the load stability circles.

Arguments

<i>n_startFreq</i>	Start of the frequency range.
<i>n_StopFreq</i>	End of the frequency range.
<i>n_step</i>	Frequency step size to be used.
<i>?resultsDir</i> <i>x_resultsDir</i>	Results directory path.

Value Returned

<i>o_waveform</i>	Waveform object representing the load stability circles.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
loadStability(2G 3G 0.2G)  
loadStability(2G 3G 0.2G?resultsDir "./psf" )
```


OCEAN Reference

Predefined and Waveform (Calculator) Functions

nc_freq

```
nc_freq(  
    n_noiseLevel  
    n_startFreq  
    n_stopFreq  
    n_step  
    [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the noise circles with fixed gain and swept frequency.

Arguments

<i>n_noiseLevel</i>	Noise level.
<i>n_startFreq</i>	Starting frequency.
<i>n_stopFreq</i>	Ending frequency.
<i>n_step</i>	Frequency step size to be used.
<i>?resultsDir</i> <i>t_resultsDir</i>	Results directory path.

Values Returned

<i>o_waveform</i>	Waveform object.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
nc_freq(2 2G 3G 0.2G)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

nc_gain

```
nc_gain(  
    n_freq  
    n_startNoiseLvl  
    n_stopNoiseLvl  
    n_step  
    [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the noise circles with fixed frequency and swept noise level.

Arguments

<i>n_freq</i>	Fixed frequency.
<i>n_startNoiseLvl</i>	Starting noise level.
<i>n_stopNoiseLvl</i>	Ending noise level.
<i>n_step</i>	Sweeping noise level step size
<i>?resultsDir</i> <i>t_resultsDir</i>	Results directory path.

Values Returned

<i>o_waveform</i>	Waveform object.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
nc_gain(2.4G 1.5 2.4 0.2)
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

NF

```
NF(  
    [ dataDir t_dataDir ]  
)  
=> o_waveform / nil
```

Description

Returns the noise figure.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

NFmin

```
NFmin(  
    [ dataDir t_dataDir ]  
    )  
=> o_waveform / nil
```

Description

Returns the minimum noise figure.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object.
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

rn

```
rn(  
    [ dataDir t_dataDir ]  
    )  
=> o_waveform / nil
```

Description

Returns the normalized equivalent noise resistance as a function of frequency.

Arguments

`dataDir t_dataDir` Results directory path.

Values Returned

<code>o_waveform</code>	Waveform object
<code>nil</code>	Returns <code>nil</code> and an error message otherwise.

sourceStability

```
sourceStability(  
    n_startFreq  
    n_stopFreq  
    n_step  
    [ ?resultsDir x_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Computes the source stability circles.

Arguments

<i>n_startFreq</i>	Start of the frequency range.
<i>n_StopFreq</i>	End of the frequency range.
<i>n_step</i>	Frequency step size to be used.
<i>?resultsDir</i> <i>x_resultsDir</i>	Results directory path.

Value Returned

<i>o_waveform</i>	Waveform object representing the source stability circles.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Example

```
sourceStability(2G 3G 0.2G)  
sourceStability(2G 3G 0.2G?resultsDir "./psf" )
```

OCEAN Reference

Predefined and Waveform (Calculator) Functions

s11

```
s11(  
  [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the response at port 1 due to a signal at port 1.

Arguments

<i>?resultsDir</i>	Results directory path.
<i>t_resultsDir</i>	

Values Returned

<i>o_waveform</i>	Waveform object
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

s12

```
s12(  
  [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the response at port 1 due to a signal at port 2.

Arguments

<i>?resultsDir</i>	Results directory path.
<i>t_resultsDir</i>	

Values Returned

<i>o_waveform</i>	Waveform object.
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

s21

```
s11(  
  [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the response at port 2 due to a signal at port 1.

Arguments

<i>?resultsDir</i>	Results directory path.
<i>t_resultsDir</i>	

Values Returned

<i>o_waveform</i>	Waveform object
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

OCEAN Reference

Predefined and Waveform (Calculator) Functions

s22

```
s22(  
  [ ?resultsDir t_resultsDir ]  
)  
=> o_waveform / nil
```

Description

Returns the response at port 2 due to a signal at port 2.

Arguments

<i>?resultsDir</i>	Results directory path.
<i>t_resultsDir</i>	

Values Returned

<i>o_waveform</i>	Waveform object
<i>nil</i>	Returns <i>nil</i> and an error message otherwise.

Parametric Analysis Commands

These commands set up a parametric analysis. When you run a parametric analysis, you can plot the resulting data as a family of curves.

This chapter contains information on the following commands:

- [paramAnalysis](#)
- [paramRun](#)

paramAnalysis

```
paramAnalysis(  
    t_desVar  
    [ ?start n_start ]  
    [ ?stop n_stop ]  
    [ ?center n_center ]  
    [ ?span n_span ]  
    [ ?step f_step ]  
    [ ?lin n_lin ]  
    [ ?log n_log ]  
    [ ?dec n_dec ]  
    [ ?oct n_oct ]  
    [ ?times n_times ]  
    [ ?spanPercent n_spanPercent ]  
    [ ?sweepType t_sweepType ]  
    [ ?values l_values ]  
    [ o_paramAnalysis ]  
)  
=> undefined / nil
```

Description

Sets up a parametric analysis.

Groups the PSF data so that it can be plotted as a family of curves when the analysis is finished. The commands can be nested as shown in the syntax of the command.

If you specify more than one range, the OCEAN environment uses the following precedence to select a single range to use.

<i>n_start, n_stop</i>	highest precedence
<i>n_center, n_span</i>	↓
<i>n_center, n_spanPercent</i>	lowest precedence

Similarly, if you specify more than one step control, the OCEAN environment uses the following precedence.

<i>f_step</i>	highest precedence
---------------	--------------------

OCEAN Reference

Parametric Analysis Commands

n_lin

n_dec

n_log

n_oct

n_times



lowest precedence

To run the analysis, use the `paramRun` command.

OCEAN Reference

Parametric Analysis Commands

Arguments

<code>t_desVar</code>	Name of the design variable to be swept.
<code>?start n_start</code>	Beginning value for the design variable.
<code>?stop n_stop</code>	Final value for the design variable.
<code>?center n_center</code>	Center point for a range of values that you want to sweep.
<code>?span n_span</code>	Range of values that you want to sweep around the center point. For example, if <code>n_center</code> is 100 and <code>n_span</code> is 20 then the sweep range extends from 90 to 110.
<code>?step f_step</code>	Increment by which the value of the design variable changes. For example, if <code>n_start</code> is 1.0, <code>n_stop</code> is 2.1, and <code>f_step</code> is 0.2, the parametric analyzer simulates at values 1.0, 1.2, 1.4, 1.6, 1.8, and 2.0.
<code>?lin n_lin</code>	<p>The number of steps in the analysis. The parametric analyzer automatically assigns equal intervals between the steps. With this option, there is always a simulation at both <code>n_start</code> and <code>n_stop</code>. The value for the <code>n_lin</code> argument must be an integer greater than 0.</p> <p>For example, if <code>n_start</code> is 0.5, <code>n_stop</code> is 2.0, and <code>n_lin</code> is 4, the parametric analyzer simulates at values 0.5, 1.0, 1.5, and 2.0.</p>
<code>?log n_log</code>	<p>The number of steps between the starting and stopping points at equal-ratio intervals using the following formula:</p> $\log \text{ multiplier} = (n_{\text{stop}}/n_{\text{start}})^{(n_{\text{log}}-1)}$ <p>The number of steps can be any positive number, such as 0.5, 2, or 6.25.</p> <p>Default value: 5</p> <p>For example, if <code>n_start</code> is 3, <code>n_stop</code> is 15, and <code>n_log</code> is 5, the parametric analyzer simulates at values 3, 4.48605, 6.7082, 10.0311, and 15.</p> <p>The ratios of consecutive values are equal, as shown below.</p> $3/4.48605 = 4.48605/6.7082 = 6.7082/10.0311 = 10.0311/15 = .67$

OCEAN Reference

Parametric Analysis Commands

?dec *n_dec*

The number of steps between the starting and stopping points calculated using the following formula:

$$\text{decade multiplier} = 10^{1/n_dec}$$

The number of steps can be any positive number, such as 0.5, 2, or 6.25.

Default value: 5

For example, if *n_start* is 1, *n_stop* is 10, and *n_dec* is 5, the parametric analyzer simulates at values 1, 1.58489, 2.51189, 3.98107, 6.30957, and 10.

The values are 10^0 , 10^{-2} , 10^{-4} , 10^{-6} , 10^{-8} , and 10^1 .

?oct *n_oct*

The number of steps between the starting and stopping points using the following formula:

The number of steps can be any positive number, such as 0.5, 2, or 6.25.

Default value: 5

For example, if *n_start* is 2, *n_stop* is 4, and *n_oct* is 5, the parametric analyzer simulates at values 2, 2.2974, 2.63902, 3.03143, 3.4822, and 4.

These values are 2^1 , $2^{1.2}$, $2^{1.4}$, $2^{1.6}$, $2^{1.8}$, and 2^2 .

$$\text{octave multiplier} = 2^{1/(n_oct)}$$

?times *n_times*

A multiplier. The parametric analyzer simulates at the points between *n_start* and *n_stop* that are consecutive multiples of *n_times*.

For example, if *n_start* is 1, *n_stop* is 1000, and *n_times* is 2, the parametric analyzer simulates at values 1, 2, 4, 8, 16, 32, 64, 128, 256, and 512.

?spanPercent *n_spanPercent*

Range specified as a percentage of the center value. For example, if *n_center* is 100 and *n_spanPercent* is 40, the sweep range extends from 80 to 120.

OCEAN Reference

Parametric Analysis Commands

`?sweepType` *t_sweepType*

Type of parametric analysis. Valid values are:

- `paramset` - Runs Parametric Set analysis, specific to Spectre.
- `nil` - Runs Sweeps & Ranges type parametric analysis.

Default value: `nil`

`?values` *l_values* List of values to be swept. You can use *l_values* by itself or in conjunction with *n_start*, *n_stop*, and *f_step* to specify the set of values to sweep.

`?paramAnalysis` *o_paramAnalysis*

Value returned from another `paramAnalysis` call used to achieve multidimensional parametric analysis.

Value Returned

`undefined` The return value for this command is undefined.

`nil` Prints an error message.

Examples

Sets up a parametric analysis for the `rs` design variable. The swept values are 200, 400, 600, 800, 1000, 1030, 1050, and 1090.

```
paramAnalysis( "rs" ?start 200 ?stop 1000 ?step 200
  ?values '(1030 1050 1090) )
```

Sets up a nested parametric analysis for the `r1` design variable.

```
paramAnalysis( "r1" ?start 200 ?stop 600 ?step 200
  paramAnalysis( "rs" ?start 300 ?stop 700 ?step 200
  )
)
```

Sets up a parametric analysis for temperature.

```
paramAnalysis("temp" ?start -50 ?stop 100 ?step 50)
```


Related Topics

[paramRun](#)

paramRun

```
paramRun(  
    [ s_paramAnalysis ]  
)  
=> t / nil  
  
paramRun(  
    [ ?jobName t_jobName ]  
    [ ?drmsCmd t_drmsCmd ]  
)  
=> s_jobName / nil  
  
paramRun(  
    [ ?jobName t_jobName ]  
    [ ?host t_hostName ]  
    [ ?queue t_queueName ]  
    [ ?startTime t_startTime ]  
    [ ?termTime t_termTime ]  
    [ ?dependentOn t_dependentOn ]  
    [ ?mail t_mailingList ]  
    [ ?block s_block ]  
    [ ?notify s_notifyFlag ]  
    [ ?lsfResourceStr s_lsfResourceStr ]  
)  
=> s_jobName / nil
```

Description

Runs the specified parametric analysis.

If you do not specify a parametric analysis, all specified analyses are run. Distributed processing must be enabled using the `hostmode` command before parametric analyses can be run in distributed mode.

When the `paramRun` command finishes, the PSF directory contains a file named `runObjFile` that points to a family of data. To plot the family, use a normal `plot` command. For example, you might use `plot(v("/out"))`.

OCEAN Reference

Parametric Analysis Commands

Arguments

<i>s_paramAnalysis</i>	Parametric analysis.
?jobName <i>t_jobName</i>	Used as the basis of the job name. The value entered for <i>t_jobName</i> is used as the job name and return value if the run command is successful. If the name given is not unique, a number is appended to create a unique job name.
?host <i>t_hostName</i>	Name of the host on which to run the analysis. If no host is specified, the system assigns the analysis to an available host.
?drmsCmd <i>t_drmsCmd</i>	<p>A DRMS (Distributed Resource Management System) command, such as a bsub command for LSF or a qsub command for SGE (Sun Grid Engine) used to submit a job. When this argument is used, all other arguments, except ?jobName will be ignored. Moreover, it will not be possible to call the OCEAN function <code>wait</code> on the jobs submitted using this argument.</p> <p>To know more about the command option, refer to the section Submitting a Job in the chapter <i><u>Using the Distributed Processing Option in the Analog Design Environment</u></i> of the <i>Virtuoso Analog Distributed Processing Option User Guide</i>.</p>
?queue <i>t_queueName</i>	Name of the queue. If no queue is defined, the analysis is placed in the default queue (your home machine).
?startTime <i>t_startTime</i>	Desired start time for the job. If dependencies are specified, the job does not start until all dependencies are satisfied.
?termTime <i>t_termTime</i>	Termination time for job. If the job is not completed by <i>t_termTime</i> , the job is terminated.
?dependentOn <i>t_dependentOn</i>	List of jobs on which the specified analysis is dependent. The analysis is not started until after dependent jobs are complete.
?mail <i>t_mailingList</i>	List of users to be notified by e-mail when the analysis is complete.
?block <i>s_block</i>	<p>When <i>s_block</i> is not <code>nil</code>, the OCEAN script halts until the job is complete.</p> <p>Default value: <code>nil</code></p>
?notify <i>s_notifyFlag</i>	<p>When <i>notifyFlag</i> is not <code>nil</code>, a job completion message is echoed to the OCEAN interactive window.</p> <p>Default value: <code>t</code></p>

OCEAN Reference

Parametric Analysis Commands

<code>?lsfResourceStr</code> <code>s_lsfResourceStr</code>	Specifies an LSF Resource Requirement string to submit a job. It is effective only in the LSF mode.
---	---

Value Returned

<code>t</code> <code>nil</code>	The specified parametric analysis is run. Prints an error message.
------------------------------------	---

Examples

Runs all specified parametric analyses.

```
paramRun()  
=> t
```

Runs the `rs` parametric analysis.

```
rsAnalysis = paramAnalysis("CAP" ?values '(10 20))  
paramRun('rsAnalysis)  
=> t
```

or

```
rsAnalysis = paramAnalysis("CAP" ?values '(10 20) paramAnalysis("RES" ?values '(10  
20 )))  
paramRun('rsAnalysis)  
=> t
```

Runs the analysis in the queue named `background` on a machine, if it has at least 500 MB of RAM memory.

```
paramRun(?queue "background" ?lsfResourceStr "mem>500")  
=> t
```

Related Topics

[paramAnalysis](#)

OCEAN Distributed Processing Commands

The Open Command Environment for Analysis (OCEAN) distributed processing commands let you run OCEAN jobs across a collection of computer systems.

This chapter contains information on the following commands:

- [deleteJob](#)
- [digitalHostMode](#)
- [digitalHostName](#)
- [hostMode](#)
- [hostName](#)
- [killJob](#)
- [monitor](#)
- [remoteDir](#)
- [resumeJob](#)
- [suspendJob](#)
- [wait](#)

This chapter also provides sample OCEAN scripts that optimally use these commands. See the section [Sample Scripts](#).

For detailed information on distributed processing, refer to [Virtuoso Analog Distributed Processing Option User Guide](#).

deleteJob

```
deleteJob(  
    t_jobName  
    [ t_jobName2 t_jobName3 ... t_jobNameN ]  
)  
=> t / nil
```

Description

Removes a job or series of jobs from the text-based job monitor.

Deleted jobs are no longer listed in the job monitor. The `deleteJob` command applies only to ended jobs.

Arguments

<i>t_jobName</i>	Name used to identify the job.
<i>t_jobname2...t_jobnameN</i>	Additional jobs that you want to delete.

Value Returned

<i>t</i>	The specified job or series of job is removed.
<i>nil</i>	Prints an error message.

Examples

Deletes the `myckt` job.

```
deleteJob( 'myckt')  
=> t
```

digitalHostMode

```
digitalHostMode(  
    { 'local' | 'remote' }  
)  
=> t / nil
```

Description

,Specifies whether the digital simulator will run locally or on a remote host for mixed-signal simulation.

Arguments

'local	Sets the simulation to run locally on the user's machine.
'remote	Sets the simulation to run on a remote host. If you use this argument, you must specify the host name by using the <code>digitalHostName</code> command.

Value Returned

t	The digital simulator is run as specified.
nil	Prints an error message.

Examples

Sets the digital simulator to run locally on the user's host.

```
digitalHostMode( 'local' )  
=> t
```

digitalHostName

```
digitalHostName(  
    t_name  
)  
=> t / nil
```

Description

Specifies the name of the remote host for the digital simulator, for mixed-signal simulations.

When you use the `digitalHostMode('remote')` command, use this command to specify the name of the remote host.

Arguments

<i>t_name</i>	Name used to identify the host for the digital simulator.
---------------	---

Value Returned

<i>t</i>	The specified name is set for the remote host.
<i>nil</i>	Prints an error message.

Examples

Indicates that the digital simulator runs on the host called `digitalhost`.

```
digitalHostName( "digitalhost" )  
=> t
```


hostMode

```
hostMode(  
    { 'local | 'remote | 'distributed }  
)  
=> t / nil
```

Description

Sets the simulation host mode.

The default value for `hostMode` is specified in the `asimenv.startup` file with the `hostMode` environment variable.

Arguments

<code>'local</code>	Sets the simulation to run locally on the user's machine.
<code>'remote</code>	Sets the simulation to run on a remote host queue. For this release, the remote host is specified in the <code>.cdsenv</code> file.
<code>'distributed</code>	Sets the simulation to run using the distributed processing software.

Value Returned

<code>t</code>	The specified simulation host mode is set.
<code>nil</code>	Prints an error message.

Examples

Enables distributed processing on the current host.

```
hostMode( 'distributed )  
=> t
```

hostName

```
hostName (
    t_name
)
=> t / nil
```

Description

Specifies the name of the remote host.

When you use the `hostMode('remote')` command, use this command to specify the name of the remote host.

Arguments

<i>t_name</i>	Name used to identify the remote host.
---------------	--

Value Returned

<i>t</i>	The specified name for the remote host is set.
<i>nil</i>	Prints an error message.

Examples

Specifies that the host called `remotehost` is to be used for remote simulation.

```
hostName( "remotehost" )
=> t
```

killJob

```
killJob(  
    t_jobName [ t_jobName2 t_jobName3 ... t_jobNameN ]  
)  
=> t / nil
```

Description

Stops processing of a job or a series of jobs.

The job might still show up in the job monitor, but it cannot be restarted. Use the `deleteJob` command to remove the job name from the job server and job monitor.

Arguments

<i>t_jobName</i>	Name used to identify the job.
<i>t_jobname2...t_jobnameN</i>	Additional jobs that you want to stop.

Value Returned

<i>t</i>	The processing of the specified job or the series of job is stopped.
<i>nil</i>	Prints an error message.

Examples

Stops the job called `myckt`. If the job is in the queue and has not started running yet, it is deleted from the queue.

```
killJob( 'myckt )  
=> t
```

monitor

```
monitor(  
    [ ?taskMode s_taskMode ]  
)  
=> t / nil
```

Description

Monitors the jobs submitted to the distributed system.

Arguments

<i>s_taskMode</i>	When not <code>nil</code> , multitask jobs are expanded to show individual jobs. A multitask job is one that contains several related jobs.
-------------------	---

Value Returned

<code>t</code>	The jobs submitted to the distributed system are monitored.
<code>nil</code>	Prints an error message.

Examples

Displays the name, host, and queue for all pending tasks sorted on a queue name.

```
monitor( ?taskMode t )  
=> t
```

remoteDir

```
remoteDir(  
    t_path  
)  
=> t / nil
```

Description

Specifies the project directory on the remote host to be used for remote simulation.

When you use the `hostMode('remote')` command, use this command to specify the project directory on the remote host.

Arguments

<i>t_path</i>	Specifies the path to the project directory on the remote host to be used for remote simulation.
---------------	--

Value Returned

<i>t</i>	The specified project directory is used for remote simulation.
<i>nil</i>	Prints an error message.

Examples

Specifies that the project directory is `~/simulation`.

```
remoteDir( "~/simulation" )  
=> t
```

resumeJob

```
resumeJob(  
    t_jobName [ t_jobName2 t_jobName3 ... t_jobNameN ]  
)  
=> t / nil
```

Description

Resumes the processing of a previously suspended job or series of jobs. The `resumeJob` command applies only to jobs that are suspended.

Arguments

<i>t_jobName</i>	Name used to identify the job.
<i>t_jobName2...t_jobNameN</i>	Additional jobs that you want to resume.

Value Returned

<i>t</i>	The processing of a previously suspended job or series of jobs is resumed.
<i>nil</i>	Prints an error message.

Examples

Resumes the `myckt` job that was halted with the `suspendJob` command.

```
resumeJob( 'myckt '  
=> t
```

suspendJob

```
suspendJob(  
    t_jobName [ t_jobName2 t_jobName3 ... t_jobNameN ]  
)  
=> t / nil
```

Description

Suspends the processing of a job or series of jobs. The `suspendJob` command applies only to jobs that are pending or running.

Arguments

<i>t_jobName</i>	Name used to identify the job.
<i>t_jobName2...t_jobNameN</i>	Additional jobs that you want to suspend.

Value Returned

<i>t</i>	The processing of a job or series of jobs is suspended.
<i>nil</i>	Prints an error message.

Examples

Suspends the job called `myckt`.

```
suspendJob( 'myckt '  
=> t
```

wait

```
wait(  
    [ ?queue t_queueName ]  
    jobName [ jobName2 jobName3 ... jobNameN ]  
)  
=> t / nil
```

Description

Postpones processing of a script until the specified jobs are completed. This command is ignored if distributed processing is not available.

The `wait` command is highly useful when you use the non-blocking mode of distributed processing and you want to do some post-processing, such as selecting and viewing results after a job is completed. The `wait` command is not required when you use the blocking mode of distributed processing.

Arguments

?queue t_queueName

The name of queue on which job launched by `wait` is submitted.

t_jobName

Name used to identify the job. The job name is user defined or system generated, depending on how the user submitted the job.

t_jobName2...t_jobnameN

Additional jobs that you want to postpone.

Value Returned

t

Processing of a script is postponed until the specified jobs are completed.

nil

Prints an error message.

Examples

Postpones execution of all subsequent OCEAN commands until the job `myckt1` completes.

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OCEAN Distributed Processing Commands

```
wait( 'myckt1 ' )  
=> t
```

Job launched by `wait` is submitted on `lnx64` queue that postpones the execution of all subsequent OCEAN commands until the job `job0` completes.

```
wait( ?queue "lnx64" 'job0 ' )  
=> t
```

Sample Scripts

This section provides sample scripts for the following:

- To submit multiple jobs and show the use of the dependentOn argument in one job
- To set up and run a simple analysis in blocking mode and select results
- To set up and run a parametric analysis in blocking mode and select results
- To submit multiple jobs without using wait or selecting results
- To submit multiple jobs using wait and selection of results

To submit multiple jobs and show the use of the dependentOn argument in one job

This script can be used to submit multiple jobs while using the dependentOn argument in one of these jobs.

```
; set up the environment for the jobs
simulator( 'spectre )
hostMode( 'distributed )
design( "/home/simulation/test2/spectre/schematic/netlist/netlist")
resultsDir( "/home/simulation/test2/spectre/schematic" )
analysis('tran ?stop "5u" )
temp( 27 )

jobList = nil

; starting first job
jobList = appendl( jobList run( ?queue "test" ?host "menaka" ) )

analysis('tran ?stop "50u")

; starting second job
jobList = appendl( jobList run(?jobName "job_2" ?queue "test" ?host "menaka"))

analysis('tran ?stop "10u")

; starting third job, which is dependent on job_2
jobList= appendl(jobList run(?jobName "disable" ?queue "test" ?dependentOn
                           symbolToString(car(last(jobList)))))

; wait for all the jobs to complete
wait((appendl last(jobList) nil))
```

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```
; open and plot the results of the jobs
openResults( car(last(jobList)) )
selectResult( 'tran' )
newWindow()
plot(getData("/net61") )
```

```
openResults( nth(1 jobList))
selectResult('tran')
newWindow()
plot(getData("/net61") )
```

To set up and run a simple analysis in blocking mode and select results

```
; set up the environment for Simple Analysis
simulator( 'spectre' )
hostMode( 'distributed' )
design(
"/home/amit/Artist446/simulation/ampTest/spectre/schematic/netlist/netlist" )
resultsDir( "/home/Artist446/simulation/ampTest/spectre/schematic" )
modelFile(
'("/home/Artist446/Models/myModels.scs" "")
)
analysis( 'tran ?stop "3u" )
desVar( "CAP" 0.8p )
temp( 27 )

; submit the job in blocking mode, to the queue test and machine menaka
run(?queue "test" ?host "menaka" ?block t)

; select and plot the results
selectResult( 'tran' )
plot(getData("/out"))
```

To set up and run a parametric analysis in blocking mode and select results

```
; set up the environment for parametric analysis.
simulator( 'spectre' )
hostMode( 'distributed' )
design(
"/home/amit/Artist446/simulation/ampTest/spectre/schematic/netlist/netlist")
resultsDir( "/home/amit/Artist446/simulation/ampTest/spectre/schematic"
)
modelFile(
```

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OCEAN Distributed Processing Commands

```
    '("/home/amit/Artist446/Models/myModels.scs" "")
)
analysis('tran ?stop "3u" )
desVar(    "CAP" 0.8p    )
temp( 27 )
paramAnalysis("CAP" ?values '(1e-13 2.5e-13 4e-13 ))

; submit the job in blocking mode, to the queue test and machine menaka
paramRun(?queue "fast" ?host "menaka" ?block t)

; select and plot the results
selectResult( 'tran )
plot(getData("/out") )
```

To submit multiple jobs without using wait or selecting results

```
; set up the environment for the jobs
simulator( 'spectre )
hostMode( 'distributed )
design(
"/home/Artist446/simulation/ampTest/spectre/schematic/netlist/netlist")
resultsDir( "/home/Artist446/simulation/ampTest/spectre/schematic" )
modelFile(
'("/home/Artist446/Models/myModels.scs" "")
)

; setup and submit first job
analysis('tran ?stop "3u" )
desVar(    "CAP" 0.8p    )
temp( 27 )
run(?queue "SUN5_5032" ?host "menaka")

; setup and submit second job
analysis('ac ?start "1M" ?stop "2M" )
analysis('tran ?stop "3u" )
desVar(    "CAP" 0.8p    )
temp( 27 )
run(?queue "SUN5_5032" ?host "menaka")
```

To submit multiple jobs using wait and selection of results

```
; set up the environment for the jobs
simulator( 'spectre )
hostMode( 'distributed )
design(
"/home/Artist446/simulation/ampTest/spectre/schematic/netlist/netlist")
resultsDir( "/home/Artist446/simulation/ampTest/spectre/schematic" )
modelFile(
    '("/home/Artist446/Models/myModels.scs" "")
)

; initialize jobList to nil
jobList = nil

; setup and submit first job
analysis('tran ?stop "3u" )
desVar(    "CAP" 0.8p    )
temp( 27 )
jobList = appendl( jobList run(?queue "SUN5_5032" ?host "menaka") )

; setup and submit second job
analysis('ac ?start "1M" ?stop "2M" )
analysis('tran ?stop "3u" )
desVar(    "CAP" 0.8p    )
temp( 27 )
jobList = appendl( jobList run(?queue "SUN5_5032" ?host "menaka"))

; wait for both the jobs to finish
wait( (appendl jobList nil) )

; open and plot the result of first job
openResults( (car jobList))
selectResult( 'tran )
plot(getData("/out") )

; open and plot the result of second job
openResults( (cadr jobList))
selectResult( 'tran )
plot(getData("/out") )
selectResult( 'ac )
```

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OCEAN Distributed Processing Commands

```
plot(getData("/out") )  
  
; delete the jobs  
foreach( x jobList deleteJob( x ) )
```

Language Constructs

There are three types of SKILL language constructs:

- Conditional statements

Conditional statements test for a condition and perform operations when that condition is found. These statements are `if`, `unless`, and `when`.

- Selection statements

A selection statement allows a list of elements, each with a corresponding operation. A variable can then be compared to the list of elements. If the variable matches one of the elements, the corresponding operation is performed. These statements include `for`, `foreach`, and `while`.

- Iterative statements

Iterative statements repeat an operation as long as a certain condition is met. These statements include `case` and `cond`.

This chapter contains information on the following statements

`case`

`if`

`cond`

`unless`

`for`

`when`

`foreach`

`while`

if

```
if (
    g_condition
    g_thenExpression
    [ g_elseExpression ]
)
=> g_result
if (
    g_condition
    then g_thenExpr1 ...
    [ else g_elseExpr1 ... ]
)
=> g_result
```

Evaluates *g_condition*, typically a relational expression, and runs *g_thenExpression* if the condition is true (that is, its value is non-nil); otherwise, runs *g_elseExpression*.

The value returned by *if* is the value of the corresponding expression evaluated.

Additionally, *if* also can also be used with the keywords *then* and *else* to group sequences of expressions for conditional execution. If the *g_condition* is true, the sequence of expressions between *then* and *else* (or the end of the *if* form) is evaluated, with the value of the last expression evaluated returned as the value of the form.

Arguments

<i>g_condition</i>	Any Virtuoso SKILL language expression
<i>g_thenExpression</i>	Any SKILL expression
<i>g_elseExpression</i>	Any SKILL expression

Value Returned

<i>g_result</i>	Returns the value of <i>g_thenExpression</i> if <i>g_condition</i> has a non-nil value. The value of <i>g_elseExpression</i> is returned otherwise.
-----------------	---

Examples

Returns 0 because *x* is less than 5.

OCEAN Reference Language Constructs

```
x = 2
if(( x > 5) 1 0)
=> 0
```

Prints the string npn and returns the result of print.

```
a ="npn"
if(( a == "npn" ) print( a ) ) "npn"
=> nil
```

Returns "non-nil" because x was not nil. If x was nil, "nil" would be returned.

```
x = 5
if( x "non-nil" "nil" )
=> "non-nil"
```

Returns 1 because x is greater than 5.

```
x = 7
if(( x > 5) then 1 else 0 )
=> 1

if( (x > 5)
then println("x is greater than 5")
  x + 1
else print("x is less ")
  x - 1)

x is greater than 5      ; Printed if x was 7.
=> 8                    ; Returned 8 if x was 7.
```

unless

```
unless(  
    g_condition  
    g_expr1 ...  
)  
=> g_result / nil
```

Description

Evaluates a condition. If the result is true (non-nil), it returns `nil`; otherwise it evaluates the body expressions in sequence and returns the value of the last expression.

The semantics of this function can be read literally as “unless the condition is true, evaluate the body expressions in sequence.”

Arguments

<i>g_condition</i>	Any SKILL expression
<i>g_expr1</i> ...	Any SKILL expression

Value Returned

<i>g_result</i>	Returns the value of the last expression of the sequence <i>g_expr1</i> ... if <i>g_condition</i> evaluates to <code>nil</code> .
<code>nil</code>	Returns <code>nil</code> if <i>g_condition</i> evaluates to non-nil.

Examples

Prints "x is negative" as a side effect.

```
x = -123  
unless( x >= 0 println( "x is negative" ) -x )  
=> 123
```

Returns `nil`.

```
unless( x < 0 println( "x is positive " ) x )  
=> nil
```

when

```
when (
    g_condition
    g_expr1 ...
)
=> g_result / nil
```

Description

Evaluates a condition.

If the result is non-nil, evaluates the sequence of expressions and returns the value of the last expression. Otherwise, returns `nil`.

Arguments

<i>g_condition</i>	Any SKILL expression
<i>g_expr1</i> ...	Any SKILL expression

Value Returned

<i>g_result</i>	Returns the value of the last expression of the sequence <i>g_expr1</i> ... if <i>g_condition</i> evaluates to non-nil.
<code>nil</code>	Returns <code>nil</code> if the <i>g_condition</i> expression evaluates to <code>nil</code> .

Example

```
x = -123
when( x < 0 println( "x is negative" ) -x )
=> 123
```

Prints "x is negative" as a side effect.

```
when( x >= 0 println( "x is positive" ) x)
=> nil
```

Returns `nil`.

for

```
for (
    s_loopVar
    x_initialValue
    x_finalValue
    g_expr1
    [ g_expr2 ... ]
)
=> t
```

Description

Evaluates the sequence *g_expr1 g_expr2 ...* for each loop variable value, beginning with *x_initialValue* and ending with *x_finalValue*.

First evaluates the initial and final values, which set the initial value and final limit for the local loop variable named *s_loopVar*. Both *x_initialValue* and *x_finalValue* must be integer expressions. During each iteration, the sequence of expressions *g_expr1 g_expr2 ...* is evaluated and the loop variable is then incremented by one. If the loop variable is still less than or equal to the final limit, another iteration is performed. The loop ends when the loop variable reaches a value greater than the limit. The loop variable must not be changed inside the loop. It is local to the `for` loop and would not retain any meaningful value upon exit from the `for` loop.

Note: Everything that can be done with a `for` loop can also be done with a `while` loop.

Arguments

<i>s_loopVar</i>	Name of the local loop variable that must not be changed inside the loop.
<i>x_initialValue</i>	Integer expression setting the initial value for the local loop variable.
<i>x_finalValue</i>	Integer expression giving final limit value for the loop.
<i>g_expr1</i>	Expression to evaluate inside loop.
<i>g_expr2 ...</i>	Additional expressions to evaluate inside loop.

Value Returned

<i>t</i>	This construct always returns <i>t</i> .
----------	--

Example

```
sum = 0
for( i 1 10
    sum = sum + i
    printf( "%d" sum ) )
=> t
```

Prints 10 numbers and returns *t*.

```
sum = 0
for( i 1 5
    sum = sum + i
    println( sum )
    )
=> t
```

Prints the value of `sum` with a carriage return for each pass through the loop:

```
1
3
6
10
15
```

foreach

```
foreach(  
    s_formalVar  
    g_exprList  
    g_expr1 [ g_expr2 ... ]  
    )  
=> l_valueList  
  
foreach(  
    ( s_formalVar1...s_formalVarN )  
    g_exprList1... g_exprListN  
    g_expr1 [ g_expr2 ... ]  
    )  
=> l_valueList  
  
foreach(  
    s_formalVar  
    g_exprTable  
    g_expr1 [ g_expr2 ... ]  
    )  
=> o_valueTable
```

Description

Evaluates one or more expressions for each element of a list of values.

The first syntax form,

```
foreach( s_formalVar g_exprList g_expr1 [g_expr2 ...] )  
=> l_valueList
```

evaluates *g_exprList*, which returns a list *l_valueList*. It then assigns the first element from *l_valueList* to the formal variable *s_formalVar* and processes the expressions *g_expr1* *g_expr2* ... in sequence. The function then assigns the second element from *l_valueList* and repeats the process until *l_valueList* is exhausted.

The second syntax form,

```
foreach( (s_formalVar1...s_formalVarN) g_exprList1... g_exprListN g_expr1 [g_expr2 ...] )=>  
l_valueList
```

can iterate over multiple lists to perform vector operations. Instead of a single formal variable, the first argument is a list of formal variables followed by a corresponding number of expressions for value lists and the expressions to be evaluated.

The third syntax form,

```
foreach( s_formalVar g_exprTable g_expr1 [g_expr2 ...])  
=> o_valueTable
```

can be used to process the elements of an association table. In this case, *s_formalVar* is assigned each key of the association table one by one, and the body expressions are evaluated each iteration. The syntax for association table processing is provided in this syntax statement.

Arguments

<i>s_formalVar</i>	Name of the variable.
<i>g_exprList</i>	Expression whose value is a list of elements to assign to the formal variable <i>s_formalVar</i> .
<i>g_expr1 g_expr2 ...</i>	Expressions to execute.
<i>g_exprTable</i>	Association table whose elements are to be processed.

Value Returned

<i>l_valueList</i>	Returns the value of the second argument, <i>g_exprList</i> .
<i>o_valueTable</i>	Returns the value of <i>g_exprTable</i> .

Example

```
foreach( x '( 1 2 3 4 ) println( x ) )  
1  
2  
3  
4  
=> ( 1 2 3 4 )
```

Prints the numbers 1 through 4 and returns the second argument to `foreach`.

```
foreach( key myTable printf( "%L : %L" key myTable[key] ) )
```

Accesses an association table and prints each key and its associated data.

```
( foreach ( x y ) '( 1 2 3 ) '( 4 5 6 ) ( println x+y ) )  
5  
7  
9  
=> ( 1 2 3 )
```

Uses `foreach` with more than one loop variable.

Errors and Warnings

The error messages from `foreach` might at times appear cryptic because some `foreach` forms get expanded to call the mapping functions `mapc`, `mapcar`, `mapcan`, and so forth.

while

```
while(  
    g_condition  
    g_expr1 ...  
)  
=> t
```

Description

Repeatedly evaluates *g_condition* and the sequence of expressions *g_expr1* ... if the condition is true.

This process is repeated until *g_condition* evaluates to false (*nil*). As this form always returns *t*, it is principally used for its side effects.

Note: Everything that can be done with a `for` loop can also be done with a `while` loop.

Arguments

<i>g_condition</i>	Any SKILL expression
<i>g_expr1</i>	Any SKILL expression

Value Returned

<i>t</i>	Always returns <i>t</i> .
----------	---------------------------

Example

```
i = 0  
while( (i <= 10) printf("%d" i++) )  
=> t
```

Prints the digits 0 through 10.

case

```
case (
  g_selectionExpr
  l_clause1 [ l_clause2 ... ]
)
=> g_result / nil
```

Description

Evaluates the selection expression, matches the resulting selector values sequentially against comparators defined in clauses, and runs the expressions in the matching clause.

Each *l_clause* is a list of the form (*g_comparator* *g_expr1* [*g_expr2*...]), where a comparator is either an atom (that is, a scalar) of any data type or a list of atoms. Comparators are always treated as constants and are never evaluated. The *g_selectionExpr* expression is evaluated and the resulting selector value is matched sequentially against comparators defined in *l_clause1* *l_clause2*.... A match occurs when either the selector is equal to the comparator or the selector is equal to one of the elements in the list given as the comparator. If a match is found, the expressions in that clause and that clause only (that is, the first match) are run. The value of `case` is then the value of the last expression evaluated (that is, the last expression in the clause selected). If there is no match, `case` returns `nil`.

The symbol `⊔` has special meaning as a comparator: it matches anything. It is typically used in the last clause to serve as a default case when no match is found with other clauses.

Arguments

<i>g_selectionExpr</i>	An expression whose value is evaluated and tested for equality against the comparators in each clause. When a match is found, the rest of the clause is evaluated.
<i>l_clause1</i>	An expression whose first element is an atom or list of atoms to be compared against the value of <i>g_selectionExpr</i> . The remainder of the <i>l_clause</i> is evaluated if a match is found.
<i>l_clause2...</i>	Zero or more clauses of the same form as <i>l_clause1</i> .

Value Returned

<i>g_result</i>	Returns the value of the last expression evaluated in the matched clause.
<i>nil</i>	Returns <i>nil</i> if there is no match.

Example

```
cornersType = "min"
type = case( cornersType
  ("min" path("./min"))
  ("typ" path("./typ"))
  ("max" path("./max"))
  (t println("you have not chosen an appropriate
    corner")))
=> path is set to "./min"
```

Sets path to ./min.

cond

```
cond(  
    l_clause1 ...  
)  
=> g_result / nil
```

Description

Examines conditional clauses from left to right until either a clause is satisfied or there are no more clauses remaining.

This command is useful when there is more than one test condition, but only the statements of one test are to be carried out. Each clause is of the form (*g_condition g_expr1...*). The `cond` function examines a clause by evaluating the condition associated with the clause. The clause is satisfied if *g_condition* evaluates to non-nil, in which case expressions in the rest of the clause are evaluated from left to right, and the value returned by the last expression in the clause is returned as the value of the `cond` form. If *g_condition* evaluates to nil, however, `cond` skips the rest of the clause and moves on to the next clause.

Arguments

<i>l_clause1</i>	Each clause must be of the form (<i>g_condition g_expr1...</i>). When <i>g_condition</i> evaluates to non-nil, all the succeeding expressions are evaluated.
------------------	--

Value Returned

<i>g_result</i>	Returns the value of the last expression of the satisfied clause.
nil	Returns nil if no clause is satisfied.

Example

```
procedure( test(x)  
    cond(((null x) (println "Arg is null"))  
        ((numberp x) (println "Arg is a number"))  
        ((stringp x) (println "Arg is a string"))  
        (t (println "Arg is an unknown type")))  
)  
test( nil )  
=> nil; Prints "Arg is null".  
test( 5 )
```

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```
=> nil; Prints "Arg is a number".  
test( 'sym )  
=> nil; Prints "Arg is an unknown type".
```

Tests each of the arguments according to the conditions specified with `cond`.

File Commands and Functions

This chapter contains information on the following commands:

close

fscanf

gets

infile

load

newline

outfile

pfile

printf

println

close

```
close(  
    p_port  
)  
=> t
```

Description

Drains, closes, and frees a port.

When a file is closed, it frees the `FILE*` associated with *p_port*. Do not use this function on `piport`, `stdin`, `poport`, `stdout`, or `stderr`.

Arguments

<i>p_port</i>	Name of port to close.
---------------	------------------------

Value Returned

<i>t</i>	The port closed successfully.
----------	-------------------------------

Example

```
p = outfile( "~/test/myFile" ) => port:"~/test/myFile"  
close( p )  
=> t
```

Drains, closes, and frees the `/test/myFile` port.

fscanf

```
fscanf(  
    p_inputPort  
    t_formatString  
    [ s_var1 ... ]  
)  
=> x_items / nil
```

Description

Reads input from a port according to format specifications and returns the number of items read in.

The results are stored into corresponding variables in the call. The `fscanf` function can be considered the inverse function of the `fprintf` output function. The `fscanf` function returns the number of input items it successfully matched with its format string. It returns `nil` if it encounters an end of file.

The maximum size of any input string being read as a string variable for `fscanf` is currently limited to 8 K. Also, the function `lineread` is a faster alternative to `fscanf` for reading Virtuoso® SKILL objects.

The common input formats accepted by `fscanf` are summarized below.

Common Input Format Specifications

Format Specification	Types of Argument	Scans for
%d	fixnum	An integer
%f	flonum	A floating-point number
%s	string	A string (delimited by spaces) in the input

Arguments

<i>p_inputPort</i>	Input port to read from.
<i>t_formatString</i>	Format string to match against in the reading.
<i>s_var1...</i>	Name of the variable in which to store results.

Value Returned

<i>x_items</i>	Returns the number of input items it successfully read in. As a side effect, the items read in are assigned to the corresponding variables specified in the call.
<i>nil</i>	Returns <i>nil</i> if an end of file is encountered.

Example

```
fscanf( p "%d %f" i d )
```

Scans for an integer and a floating-point number from the input port *p* and stores the values read in the variables *i* and *d*, respectively.

Assume a file *testcase* with one line:

```
hello 2 3 world
x = infile("testcase")
=> port:"testcase"
fscanf( x "%s %d %d %s" a b c d )
=> 4
(list a b c d) => ("hello" 2 3 "world")
```

gets

```
gets(  
    s_variableName  
    [ p_inputPort ]  
)  
=> t_string / nil
```

Description

Reads a line from the input port and stores the line as a string in the variable. This is a macro.

The string is also returned as the value of `gets`. The terminating newline character of the line becomes the last character in the string.

Arguments

<i>s_variableName</i>	Variable in which to store the input string.
<i>p_inputPort</i>	Name of input port. Default value: <code>piport</code>

Value Returned

<i>t_string</i>	Returns the input string when successful.
<code>nil</code>	Returns <code>nil</code> when the end of file is reached. (<i>s_variableName</i> maintains its last value.)

Example

Assume the `test1.data` file has the following first two lines:

```
#This is the data for test1  
0001 1100 1011 0111  
p = infile("test1.data") => port:"test1.data"  
gets(s p) => "#This is the data for test1"  
gets(s p) => "0001 1100 1011 0111"  
s => "0001 1100 1011 0111"
```

Gets a line from the `test1.data` file and stores it in the variable `s`. The `s` variable contains the last string stored in it by the `gets` function.

infile

```
infile(  
    S_fileName  
)  
=> p_inport / nil
```

Description

Opens an input port ready to read a file.

Always remember to close the port when you are done. The file name can be specified with either an absolute path or a relative path. In the latter case, the current SKILL path is used if it is not `nil`.

Arguments

<i>S_fileName</i>	Name of the file to be read; it can be either a string or a symbol.
-------------------	---

Value Returned

<i>p_inport</i>	Returns the port opened for reading the named file.
<code>nil</code>	Returns <code>nil</code> if the file does not exist or cannot be opened for reading.

Example

```
in = infile( "~/test/input.il" ) => port:"~/test/input.il"  
close( in )  
=> t
```

Closes the `/test/input.il` port.

Opens the input port `/test/input.il`.

```
infile("myFile") => nil
```

Returns `nil` if `myFile` does not exist according to the current setting of the SKILL path or exists but is not readable.

load

```
load(  
    t_fileName  
    [ t_password ]  
)  
=> t
```

Description

Opens a file and repeatedly calls `lineread` to read in the file, immediately evaluating each form after it is read in.

This function uses the file extension to determine the language mode (`.il` for SKILL, `.ils` for SKILL++, and `.ocn` for a file containing OCEAN commands) for processing the language expressions contained in the file. For a SKILL++ file, the loaded code is always evaluated in the top-level environment.

`load` closes the file when the end of file is reached. Unless errors are discovered, the file is read in quietly. If `load` is interrupted by pressing `Control-c`, the function skips the rest of the file being loaded.

SKILL has an autoload feature that allows applications to load functions into SKILL on demand. If a function being run is undefined, SKILL checks to see if the name of the function (a symbol) has a property called `autoload` attached to it. If the property exists, its value, which must be either a string or an expression that evaluates to a string, is used as the name of a file to be loaded. The file should contain a definition for the function that triggered the autoload. Processing proceeds normally after the function is defined.

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File Commands and Functions

Arguments

<i>t_filename</i>	File to be loaded. Uses the file name extension to determine the language mode to use. Valid values: <ul style="list-style-type: none">■ <code>.ils</code> - Means the file contains SKILL++ code.■ <code>.ocn</code> - Means the file contains OCEAN commands (with SKILL or SKILL++ commands)
<i>t_password</i>	Password, if <i>t_filename</i> is an encrypted file.

Value Returned

<i>t</i>	Returns <i>t</i> if the file is successfully loaded.
----------	--

Example

```
load( "test.ocn" )
```

Loads the `test.ocn` file.

```
procedure( trLoadSystem()  
  load( "test.il" ) ;;; SKILL code  
  load( "test.ils" ) ;;; SKILL++ code  
) ; procedure
```

You might have an application partitioned into two files. Assume that `test.il` contains SKILL code and `test.ils` contains SKILL/SKILL++ code. This example loads both files.

newline

```
newline(  
    [ p_outputPort ]  
)  
=> nil
```

Description

Prints a newline (backslash `\n`) character and then flushes the output port.

Arguments

<i>p_outputPort</i>	Output port.
	Defaults value: <code>poport</code>

Value Returned

<code>nil</code>	Prints a newline and then returns <code>nil</code> .
------------------	--

Example

```
print( "Hello" ) newline() print( "World!" )  
"Hello"  
"World!"  
=> nil
```

Prints a newline character after `Hello`.

outfile

```
outfile(  
    S_fileName  
    [ t_mode ]  
)  
=> p_outport / nil
```

Description

Opens an output port ready to write to a file.

Various print commands can write to this file. Commands write first to a character buffer, which writes to the file when the character buffer is full. If the character buffer is not full, the contents are not written to the file until the output port is closed or the `drain` command is entered. Use the `close` or `drain` command to write the contents of the character buffer to the file. The file can be specified with either an absolute path or a relative path. If a relative path is given and the current SKILL path setting is not `nil`, all directory paths from SKILL path are checked in order, for that file. If found, the system overwrites the first updatable file in the list. If no updatable file is found, it places a new file of that name in the first writable directory.

Arguments

<i>S_fileName</i>	Name of the file to open or create.
<i>t_mode</i>	Mode in which to open the file. If <code>a</code> , the file is opened in append mode; If <code>w</code> , a new file is created for writing (any existing file is overwritten). Default value: <code>w</code>

Value Returned

<i>p_outport</i>	An output port ready to write to the specified file.
<i>nil</i>	returns <code>nil</code> if the named file cannot be opened for writing. An error is signaled if an illegal mode string is supplied.

Example

```
p = outfile( "/tmp/out.il" "w" )  
=> port: "/tmp/out.il"
```

Opens the `/tmp/out.il` port.

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File Commands and Functions

```
outfile( "/bin/ls" )  
=> nil
```

Returns `nil`, indicating that the specified port could not be opened.

pfile

```
pfile(  
    [ S_fileName | p_port ]  
)  
=> p_port / nil
```

Description

Opens an output port ready to write to a file or returns the name of an existing port indicating that it is available.

This command is similar to the `outfile` command when a valid `S_fileName` is specified. When `p_port` is specified, it returns the file port that is currently being used by `p_port`. When no argument is specified, it opens the `stdout` port.

Arguments

<i>S_fileName</i>	Name of the file to open or create.
<i>p_port</i>	Retrieves the name of the file port that is being used.

Value Returned

<i>p_port</i>	The ID of the port that was opened, or <code>stdout</code> .
<code>nil</code>	Returns <code>nil</code> if the named file cannot be opened for writing.

Example

```
p = pfile( "/tmp/out.il" "w" )  
=> port:"/tmp/out.il"
```

Opens the `/tmp/out.il` port.

```
pfile( "/bin/ls" )  
=> nil
```

Returns `nil`, indicating that the specified port could not be opened.

```
p = pfile()  
=> port:"*stdout*"
```

Returns `stdout` as the file port indicating that `stdout` has been opened.

```
pfile( p )  
=> port:"/tmp/out.il"
```

Returns the file port.

printf

```
printf(  
    t_formatString  
    [ g_arg1 ... ]  
)  
=> t
```

Description

Writes formatted output to *poport*, which is the standard output port.

The optional arguments following the format string are printed according to their corresponding format specifications. Refer to the Common Output Format Specifications table for [fprintf](#) in the *Cadence SKILL Language User Guide*.

`printf` is identical to `fprintf` except that it does not take the *p_port* argument and the output is written to *poport*.

Arguments

<i>t_formatString</i>	Characters to be printed verbatim, intermixed with format specifications prefixed by the “%” sign.
<i>g_arg1...</i>	Arguments following the format string are printed according to their corresponding format specifications.

Value Returned

<i>t</i>	Prints the formatted output and returns <i>t</i> .
----------	--

Example

```
x = 197.9687 => 197.9687  
printf( "The test measures %10.2f." x )
```

Prints the following line to *poport* and returns *t*.

```
The test measures 197.97. => t
```

println

```
println(  
    g_value  
    [ p_outputPort ]  
)  
=> nil
```

Description

Prints a SKILL object using the default format for the data type of the value, and then prints a newline character.

A newline character is automatically printed after printing *g_value*. The `println` function flushes the output port after printing each newline character.

Arguments

<i>g_value</i>	Any SKILL value.
<i>p_outputPort</i>	Port to be used for output. Default value: <code>poport</code>

Value Returned

<code>nil</code>	Prints the given object and returns <code>nil</code> .
------------------	--

Example

```
for( i 1 3 println( "hello" ))  
"hello"  
"hello"  
"hello"  
=> t
```

Prints hello three times. `for` always returns `t`.

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File Commands and Functions

OCEAN 4.4.6 Issues

For the 4.4.6 release of OCEAN, there are some restrictions and requirements.

The netlist file that you specify for the Spectre® circuit simulator interface with the `design` command must be `netlist`. The full path can be specified. For example, `/usr/netlist` is acceptable. The `netlistHeader` and `netlistFooter` files are searched in the same directory where the netlist is located. Cadence recommends that you use the netlist generated from the Virtuoso® Analog Design Environment. Netlists from other sources can also be used, as long as they contain only connectivity. You might be required to make slight modifications.

- Cadence recommends full paths for the Spectre simulator model files, definition files, and stimulus files.
- The Cadence SPICE circuit simulator is still used to parse netlists for socket interfaces (`spectreS` and `cdsSpice`, for example). Therefore, the netlist that you specify with the `design` command must be in Cadence SPICE syntax. Cadence recommends that you use the raw netlist generated from the Virtuoso® Analog Design Environment. Netlists from other sources can also be used, as long as they can pass through Cadence SPICE. You might be required to make slight modifications.
- Any presimulation commands that you specify are appended to the final netlist (as is currently the case in the design environment). Therefore, if you have control cards already in your netlist, and specify simulation setup commands, you might duplicate control cards, which causes a warning or an error from the simulator. You might want to remove control cards from your netlist file to avoid the warnings.
- Models, include files, stimulus files, and PWLF files must be found according to the path specified with the `path` command.

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