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Batch Simulation

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About Batch Simulation

This documentation describes the ADS Batch simulation controller. It explains how to set it up for various types of sweeps, and provides examples.

Using the Batch simulation controller, you can perform extensive parametric sweeps of:

- Design variables
- Device parameters
- Data files
- IBIS device parameters
- Netlist Include files

There are two key operations you must complete before performing a batch simulation:

- Specify the variation which includes identifying the variables that should be swept and what values these variables will take.
- Specify which analyses to perform on the circuit as the variables are being swept.

For details, see *Using Batch Simulation* (cktsimbatch).

In ADS, the Batch simulation controller, named *BatchSimController*, is available in the *Simulation-Batch* palette. No additional license is required to use Batch simulation.

Using Batch Simulation

This section explains how to use the Batch Simulation controller and its related components DataFileList, StringList, and NetlistIncludeList.

To prepare a batch simulation, you must specify the variation and the analyses to run. The following sections describe how to specify these two requirements, and how to use the related Batch Simulation components to complete the setup. Designs that demonstrate the following descriptions are located in *examples/Tutorial/BatchSim_Example1_wrk*.

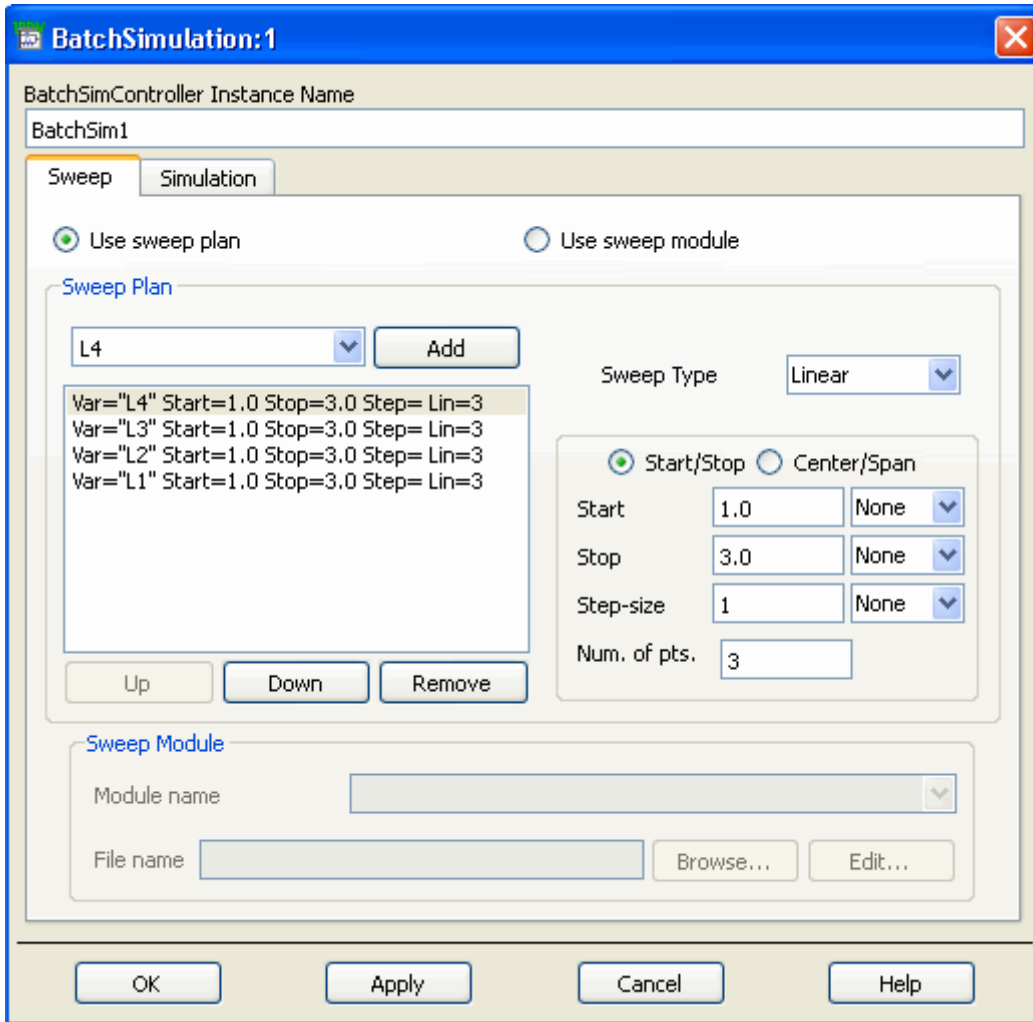
Specifying the Variation

You can specify the variable variations using either a set of sweep plans or by using sweep modules. When using sweep plans, you enter the sweep variation details directly in the Batch Simulation controller. If you use sweep modules, you name the CSV-formatted file containing the sweep information.

Using a Sweep Plan

Use the cell *Batch_SweepPlan* for the following explanation:

1. Double-click the **Batch Simulation** controller to display the setup dialog box, and select the Sweep tab.



2. On the Sweep tab, select **Use sweep plan**.
3. In the variable entry field add the variable that you want to sweep. You can select a name that may exist on the drop-down list, or type in the name directly. Click **Add** after entering the name.
4. Specify the sweep variation. Select the **Sweep Type**, and the **Start/Stop** or **Center/Span** values. For Linear sweeps, when you enter a value for *Step-size* or *Num. of pts.*, the other value is calculated for you. The same action occurs for Log sweeps when entering a value for *Pts./decade* or *Num. of pts.*
5. Click **Apply** if you will add more variables, or click **OK** to close the dialog box. The sweep plan is updated with either action.

Using a Sweep Module

Use the cells *Batch_CSVList* and *Batch_CSVSweep* for the following explanation:

1. Double-click the **Batch Simulation** controller to display the setup dialog box.
2. On the Sweep tab, select **Use sweep module**.
3. There are two CSV (comma separated value) formats available: *CSV_List* and *CSV_Sweep*. Set **Module name** (located in the **Sweep Module** area) to the format you want to use. For a description of these formats, see [CSV_List Format](#) and [CSV_Sweep Format](#).
4. Specify the CSV file name in the field **Module argument** making sure to surround

the file name with quotation marks (for example, enter the name *MySweep.csv* as "*MySweep.csv*"). The path to the file should be specified relative to the workspace data directory.

CSV_List Format

This format specifies the variable names separated by commas in the first line and the following lines specify the values these variables should take. This is shown in the following example:

```
Impedance_Variable,Filename_Variable
50.0,"File1.s1p"
100.0,"File1.s1p"
50.0,"File2.s1p"
100.0,"File2.s1p"
```

For the above case, the variables specified in the first line that will be swept are *Impedance_Variable* and *Filename_Variable*. Each line in the CSV file specifies the values which these two variables use during the sweep.

CSV_Sweep Format

This format enables you to specify the variation using a linear or logarithmic combination. Each line contains the variable to be varied, followed by the range of values that the variable will assume. The simulator performs the analyses for each combination of the listed variables. The general format is as follows:

For linear variation:

```
<VariableName>,<Start>,<Stop>,<StepSize>,linear
```

For logarithmic variation:

```
<VariableName>,<Start>,<Stop>,<NumberOfPoints>,log
```

Following is an example of the content of two CSV_Sweep formatted variables:

```
Length1,1,100,10,linear
Length2,1,100,10,log
```

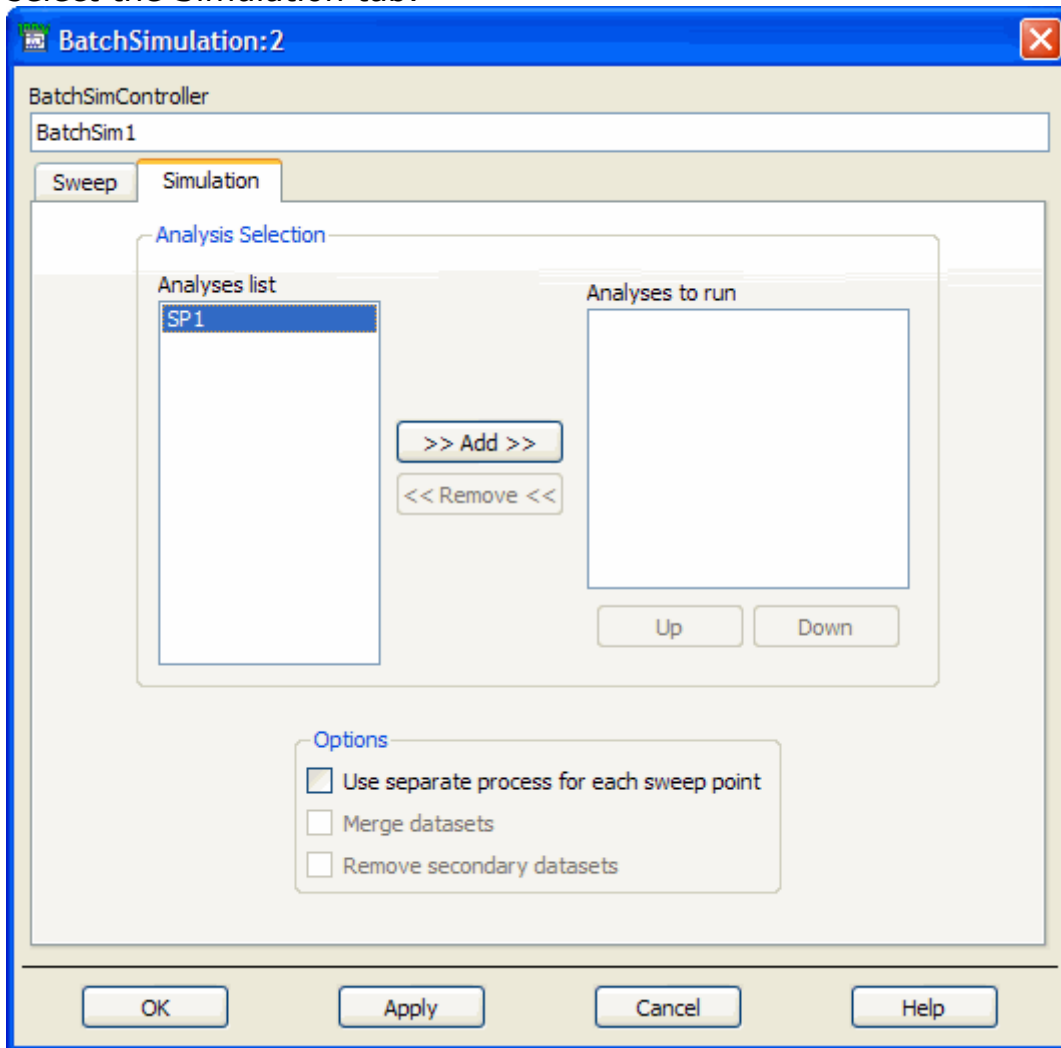
In this example two variables swept are: *Length1* and *Length2*. *Length1* is being varied linearly from 1 to 100 in steps of 10. Similarly *Length2* is being varied logarithmically from 1 to 100 using 10 points.

Specifying the Analyses

Use the cell *Batch_SweepPlan* for the following explanation:

1. Double-click the **Batch Simulation** controller to display the setup dialog box and

select the Simulation tab.



2. On the Simulation tab under **Analyses List**, select the analysis that you want to perform during the sweep. Click **Add** to add it to the **Analyses to run** list.
3. If there are any analyses under **Analyses to run** that you do not want to perform, select them and click **Remove**.

Simulation Options

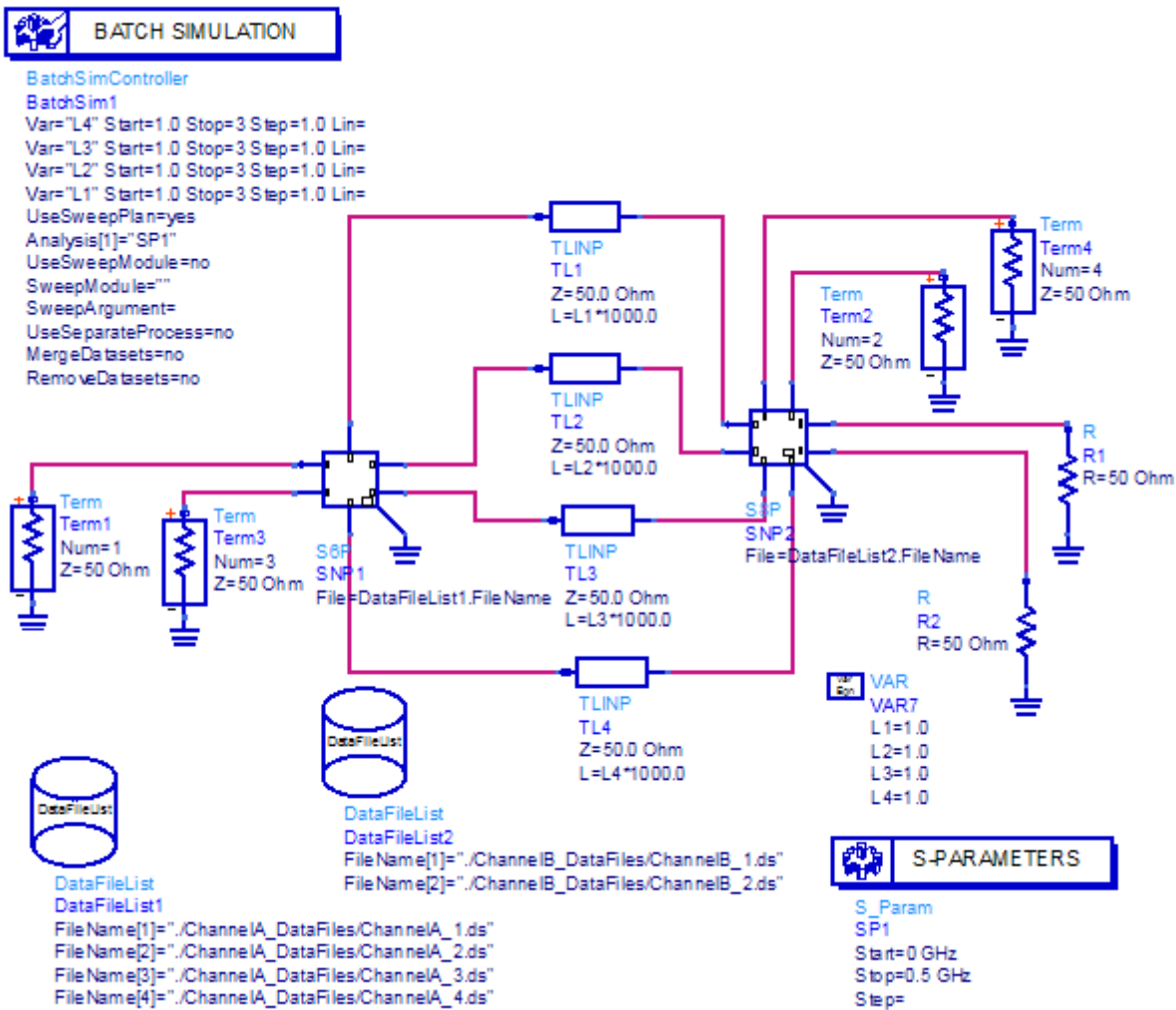
The choices under *Options* enable you to run each sweep point using a separate simulation process. If you do decide to perform each sweep using a separate process you can choose to merge the data produced into a single dataset and remove the secondary datasets.

Using the DataFileList and StringList Components

The DataFileList and the StringList components (on the Simulation-Batch palette) are used to specify a list of strings. The example below (from *Batch_SweepPlan*) shows how to use the DataFileList. The same procedure applies for the StringList.

Using the DataFileList component you can easily specify the list of data files. This list can then be swept for all possible values using the Batch Simulation controller. The following example shows how to specify the sweep using DataFileList components.

Figure: Specifying a Sweep Using DataFileList Components in a Design



To use the DataFileList component:

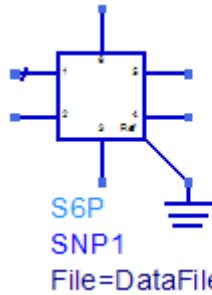
1. Place a **DataFileList** component from the **Simulation-Batch** palette.
2. Double-click the **DataFileList** and populate the DataFileList with the data file names that you want to use.



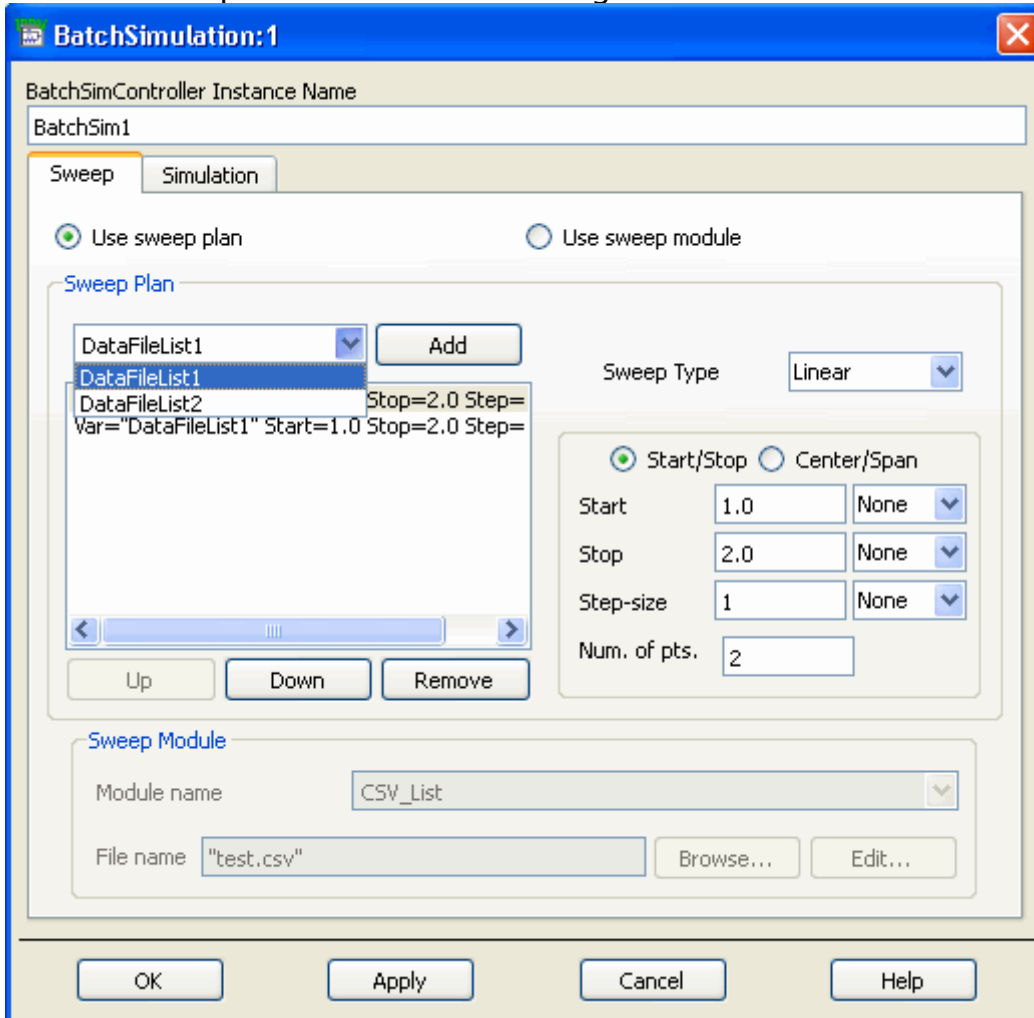
```

DataFileList
DataFileList1
FileName[1]="./ChannelA_DataFiles/ChannelA_1.ds"
FileName[2]="./ChannelA_DataFiles/ChannelA_2.ds"
FileName[3]="./ChannelA_DataFiles/ChannelA_3.ds"
FileName[4]="./ChannelA_DataFiles/ChannelA_4.ds"
    
```

3. Assign the **FileName** parameter to the component that you want that file name to take. In the case below we are assigning the file name to the S6P component. Note that *DataFileList1* is the instance name of the DataFileList component.



4. Double-click the **Batch Simulation** controller. On the Sweep tab, in the variable entry pull down box, you should be able to see the *DataFileList* component as one of sweepable parameters. Add that component and select the range through which you want to sweep. Note that the starting index is 1.



Using the NetlistIncludeList Component

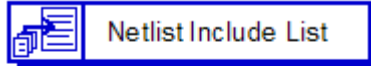
The NetlistIncludeList component can be used to specify a list of netlist include files that you want to sweep. This component can be used only in conjunction with the Batch Simulation controller.

To use the NetlistIncludeList component:

1. Place a **NetlistIncludeList** component onto the schematic. The NetlistIncludeList is

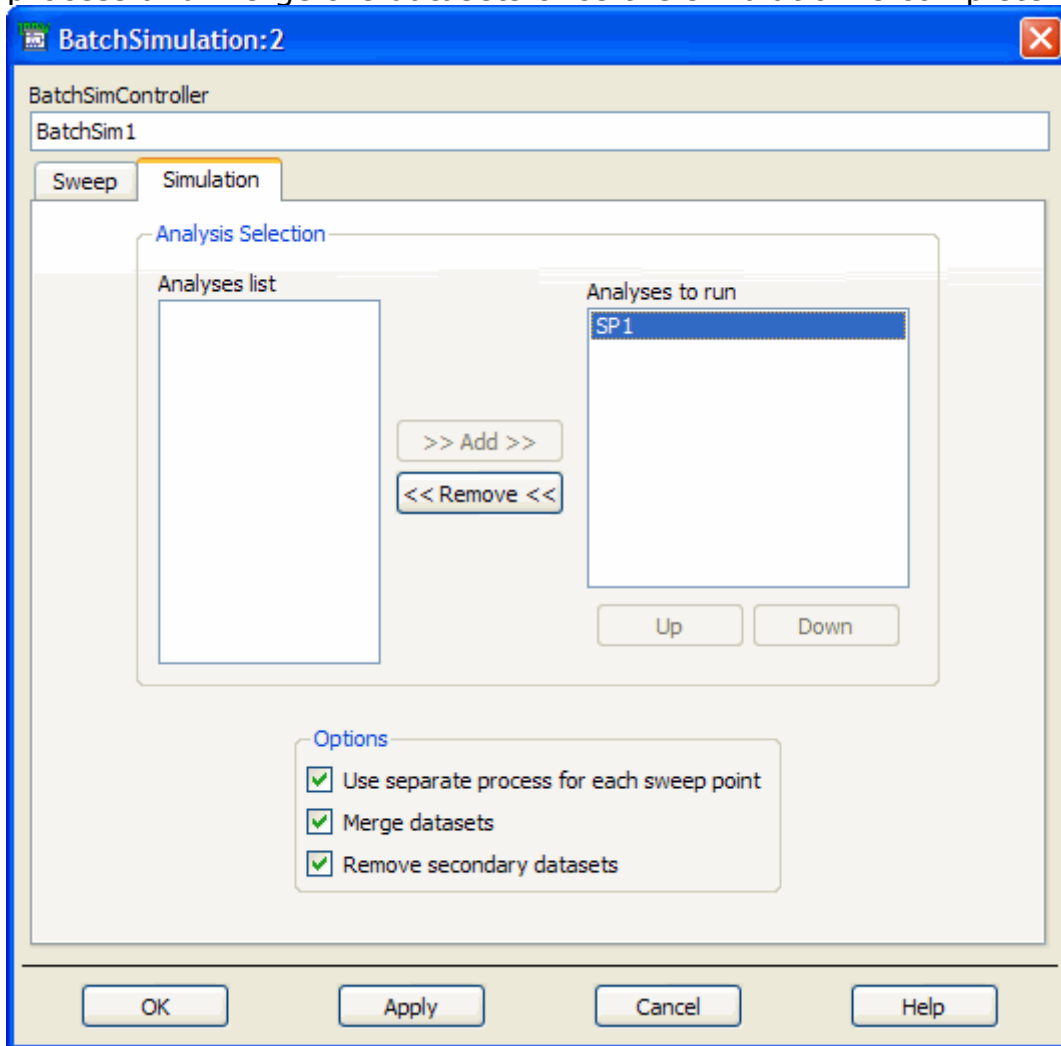
located on the **Simulation-Batch** palette.

2. Double-click the component and populate it using your netlist include files. Make sure to specify the proper netlist type under *Parameter Entry Mode*. You can specify *SPICE* and *Spectre* formats, in addition to the native *ADS* format.



```
NetlistIncludeList
NetlistIncludeList1
NetlistName[1]="File1.ckt"
NetlistName[2]="File2.ckt"
```

3. Double-click the **Batch Simulation** controller. On the Sweep tab, in the variable entry pull down box, you should be able to see the *NetlistIncludeList* component as one of sweepable parameters. Add that component and select the range that you want to sweep for. Note that the starting index is 1.
4. On the Simulation tab make sure to select **Use separate process for each sweep point** and **Merge datasets**. This will run each sweep point in a separate simulator process and merge the datasets once the simulation is complete.

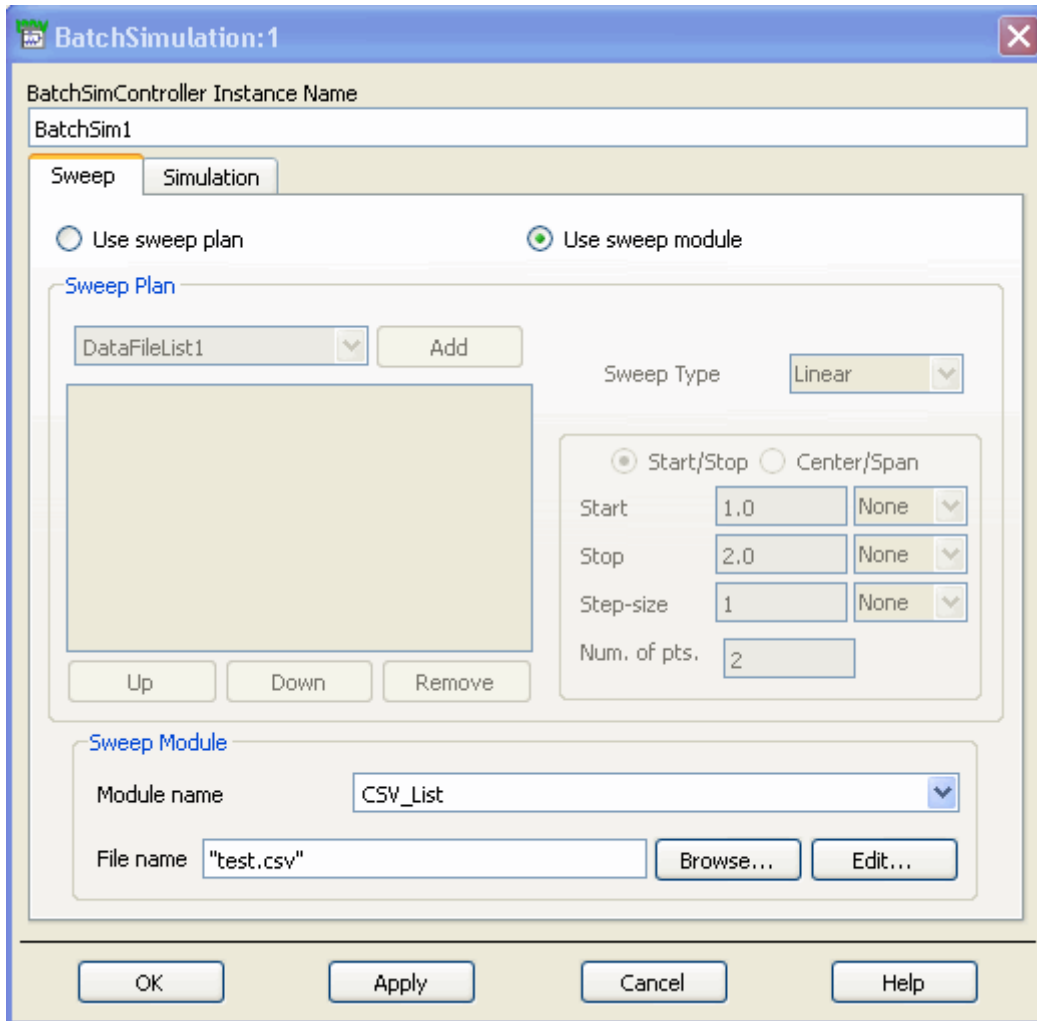


Sweeping IBIS Files

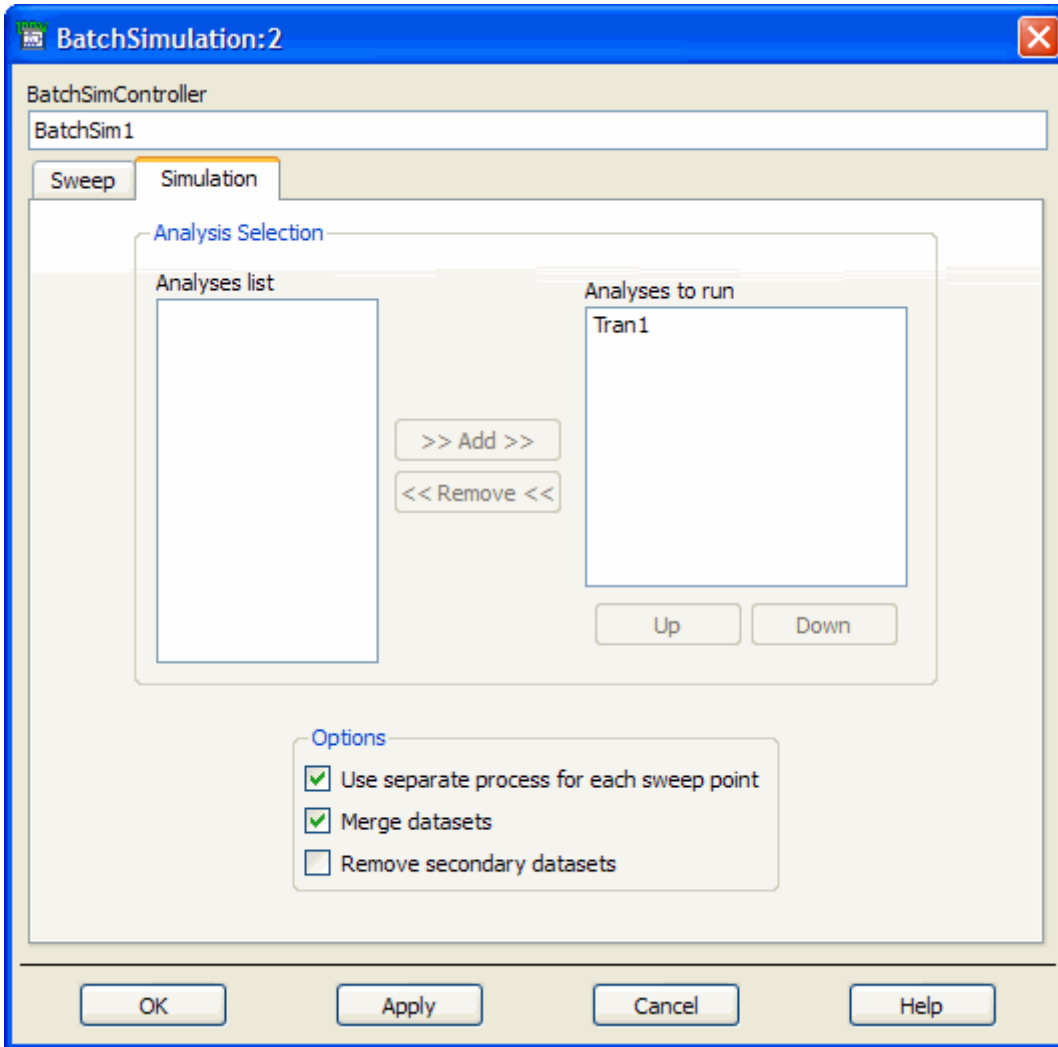
Conventional parameter sweeps can be performed with most of the IBIS parameters (see *Sweeping IBIS Parameters* (ibis) for details). However, to perform an advanced sweep of IBIS files and models, you must use Batch Simulation. This is more challenging than

sweeping other files such as the *S-parameters* data files. When a new IBIS file is selected, a number of other parameters must change simultaneously - most notably the IBIS model name. Therefore, the entire setup is subject to change. The proper mode of Batch Simulation requires the use of a *Sweep Module* and each simulation must be invoked in a separate process. This setup is shown in the following figures.

The following figure shows the Batch Simulation controller's Sweep tab set to use a sweep module to sweep IBIS files.



The following figure shows the Batch Simulation controller's Simulation tab set to use a separate process for each sweep point to sweep IBIS files.



The setup for sweeping IBIS files and models involves the following steps:

1. Set all the required aliases in the Alias tab of the IBIS dialog. For details, see *Alias Tab* (ibis).
2. Define the aliases as variables using a VAR component.
3. Define the various IBIS file names using a DataFileList component.
4. Define the various IBIS component names using a StringList component.
5. Define the various IBIS Pin names (numbers) using a StringList component.
6. Define the various IBIS model names using a StringList component.
7. If needed, define the various IBIS InvPin names (numbers) using a StringList component.

While it is not necessary to define the individual strings using separate StringList components (even the IBIS file names can be defined using a StringList component), it is the least error-prone approach. The recommended way is to use separate lists, as well as to align the corresponding entries between the lists, so that the entries corresponding to the same index provide a consistent set of the IBIS names.

A correct *Sweep Module* to perform synchronized sweeps is **CSV_List**, as shown on the Sweep tab in the figure above. The details for each simulation must be provided in a user-defined *.csv file like the one shown in the following example.

	A	B	C	D	E
1	DataFileList1	StringList1	StringList2	StringList3	
2	1	1	1	1	
3	2	2	2	2	
4					
5					
6					
7					
8					

This CSV setup will perform a two-point sweep with the following values:

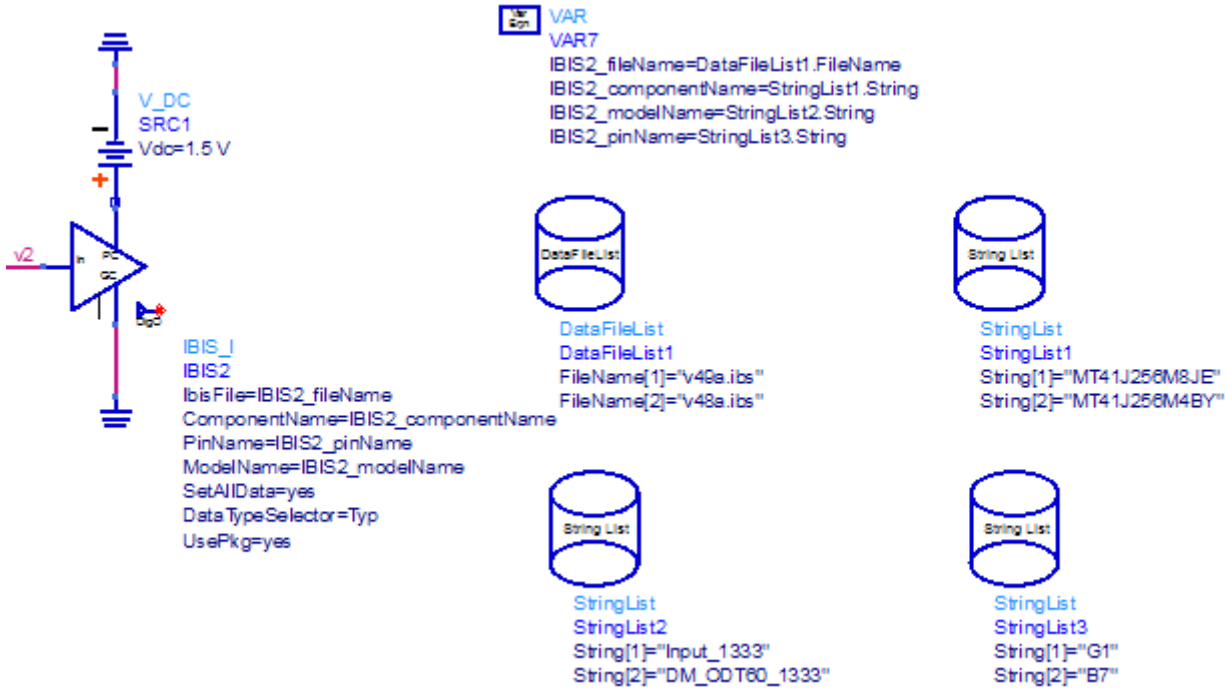
Step 1

```
DataFileList1.FileName[1]
StringList1.String[1]
StringList2.String[1]
StringList3.String[1]
```

Step 2

```
DataFileList1.FileName[2]
StringList1.String[2]
StringList2.String[2]
StringList3.String[2]
```

The strings and file names in these lists must be linked to aliases specified in the IBIS component as shown in the following example.



In this example circuit, these aliases are defined as variables in the *VAR* component and linked to the respective lists using the following syntax:

alias_name = DataFileListX.FileName

or

alias_name = StringListX.String

The value of *X* identifies the corresponding instance of the list.