

Hints, Tips and Solutions

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New Functionality – BUS notation in SmartSpice

A new notation has been introduced into SmartSpice to allow a compact expression of a multiple bit wire buss to be used. From this expression the user can simply state the members of a wire bus he wants to generate vectors for or probe. This syntax can be used in conjunction with .SAVE .PROBE

```
Bus_name<n:m:i>
```

```
Bus_name[n - m - i]
```

Bus_name: an ASCII character string naming the set of wires. N, M, I : a positive integer number <> or [] : Indicates the expression to be expanded.

Syntax	Num. Bit's	Expanded form
--------	------------	---------------

B<0:2>	3	b<0>,b<1>,b<2>
--------	---	----------------

B<0:2:1>	3	b<0,1,2>
----------	---	----------

B<3:0:2>	2	b<3,1>
----------	---	--------

B<0:1,2:2>	3	b<0,1,2>
------------	---	----------

DATA<2,1,0> represents DATA<2>,DATA<1>, and DATA<0>

Bus Expression Expanded to the single bit level.

DATA<0:3:2> indicates a 2-bit bus containing elements DATA<0> and DATA<2>

DATA<1:3:2> indicates a 2-bit bus containing elements DATA<1> and DATA<3>

DATA<0:3> indicates a 4-bit bus containing elements DATA<0>, DATA<1>, DATA<2> and DATA<3>

DATA<2:0> indicates a 3-bit bus containing elements DATA<2>, DATA<1> and DATA<0>

The following 2 examples show how the different forms of this abbreviation for a set of bus wires can be used.

Example 1

```
* Test bus notation in .COMMANDS
```

```
V1 1 0 1
```

```
R1 1 bus<1> 1
```

```
R2 bus<1> bus<2> 1
```

```
R3 bus<2> bus<3> 1
```

```
R4 bus<3> bus<4> 1
```

```
R5 bus<4> 0 1
```

```
.options nomod
```

```
.tran 1n 5n
```

```
.save v(bus<1-4>)
```

```
.print v(bus<1:4>)
```

```
.print v(bus<1-4-2>)
```

```
.print v(bus<4-1-2>)
```

```
.print v(bus<1,3:4>)
```

```
.end
```

Example 2

```
* Test bus notation in shell commands
```

```
V1 1 0 1
```

```
R1 1 bus[1] 1
```

```
R2 bus[1] bus[2] 1
```

```
R3 bus[2] bus[3] 1
```

```
R4 bus[3] bus[4] 1
```

```
R5 bus[4] 0 1
```

```
.options nomod
```

```
.control
```

```
save v(bus[1-4])
```

```
tran 1n 5n
```

```
print v(bus[1:4])
```

```
print v(bus[1-4-2])
```

```
print v(bus[4-1-2])
```

```
print v(bus[1,3:4])
```

```
.endc
```

```
.end
```

New Functionality – NET statement .

A new optional parameter OUTMODE in the .NET analysis statement was added

A new optional parameter OUTMODE=MODEL|DATA was added to NET (Small-Signal Multi-Terminal Network Analysis) statement. The parameter value 'MODEL' changes the format and content of the created external file, which contains S- or Y-parameter matrices. When OUTMODE=MODEL the S- or Y-parameter matrices are written as .MODEL SP statement lines, they can be included in .MODEL input statement using .INCLUDE. Default OUTMODE=DATA saves results in the external file in the previous DATAFILE format.

Example:

```

File sdata.par with DATAFILE format
(OUTMODE=DATA):
* N=6 FSTART=1e+09 FSTOP=1e+10
* SPACING=LINEAR MATRIX=SYMMETRIC
VALTYPE=CARTESIAN
*** S - parameters DATAFILE ***
*** ===== ***
+ 10 $$ - number of data points
*** in 1 n 1 in 2
*** RealData ImaginaryData RealData
*** --- f[0]=1.000000e+09 -----
3.548139090830e-02 1.681117508985e-03
4.657982349517e-05 4.070485598498e-03
3.547320948755e-02 ...
3.255123897577e-05 2.361486905465e-03
4.774625207240e-05 ...
9.644822616780e-01 -7.860329805485e-03 -
2.632056547515e-05 ...
-2.504703481764e-05 -1.766573638517e-03
9.644644984382e-01 ...
-2.744819175282e-05 -1.879679982283e-03
-2.640582770474e-05 ...
*** --- f[1]=2.000000e+09 -----
3.554542140701e-02 3.360250854423e-03
1.842940723429e-04 8.132855137570e-03
3.550913774506e-02 ...
1.293936542282e-04 4.721282832777e-03
1.845192935379e-04 ...
9.643114004049e-01 -1.571913862632e-02 -
9.926995728703e-05 ...
-9.875707611075e-05 -3.523037411001e-03
9.642434342675e-01 ...
-1.097405545596e-04 -3.754516558774e-03
-9.972001067792e-05 ...
.....

```

can be used in S-device model as:

```

S1 1 3 5 2 4 6 0 FQMODEL=testQuest
TYPE=s
.model testQuest SP
+ N=6
+ FSTART=1e9 FSTOP=1e10 NI=10
SPACING=lin
+ MATRIX=SYMMETRIC VALTYPE=CARTESIAN
+ DATAFILE=sdata.par

```

File smodel.par with MODEL line format (OUTMODE=MODEL):

```

*** S - parameters DATAFILE ***
+ N=6 FSTART=1e+09 FSTOP=1e+10
+ SPACING=LINEAR MATRIX=SYMMETRIC
VALTYPE=CARTESIAN
+ TYPE = S
+ DATA=(
+ 10 $$ - number of data points

```

```

22 of 91SILVACO International*** in
1 in 1 in 2 *** RealData Imaginary-
Data RealData *** --- f[0]=1.000000e+09
----- + 3.548139090830e-02
1.681117508985e-03 + 4.657982349517e-05
4.070485598498e-03 3.547320948755e-02 ...
+ 3.255123897577e-05 2.361486905465e-03
4.774625207240e-05 ... + 9.644822616780e-
01 -7.860329805485e-03 -2.632056547515e-
05 ... + -2.504703481764e-05 -
1.766573638517e-03 9.644644984382e-01 ...
+ -2.744819175282e-05 -1.879679982283e-
03 -2.640582770474e-05 ... *** --
- f[1]=2.000000e+09 ----- +
3.554542140701e-02 3.360250854423e-03
+ 1.842940723429e-04 8.132855137570e-
03 3.550913774506e-02 ... +
1.293936542282e-04 4.721282832777e-03
1.845192935379e-04 ... + 9.643114004049e-
01 -1.571913862632e-02 -9.926995728703e-
05 ... + -9.875707611075e-05 -
3.523037411001e-03 9.642434342675e-01 ...
+ -1.097405545596e-04 -3.754516558774e-03
-9.972001067792e-05 ... ..... + )

```

can be used in S-device model as

```

S1 1 3 5 2 4 6 0 FQMODEL=testQuest
.model testQuest SP .include smodel.par

```

NET Analysis

In previous versions of SMARTSPICE it was possible to specify only NET analysis specific vectors in output statements (s11, s12, ..., gamax, etc.). Now vectors that can be specified, and are not limited to NET analysis specific vectors. Expressions can be used as well.

Example:

```

.LET NET rh11='real(h11)'
rh22m='real(h22)+2' foovec='2+3'

.PRINT NET real(s11) rh11 rh22m
rh11+rh22m foovec

```

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