

Sparse Matrix Mapping Draft 8

12/15/2009

[Number of Sparse Labels]

Rules for Version 1.0-2.0 files:

[Number of Sparse Labels] is not permitted in Version 1.0-2.0 files.

Rules for Version 2.1 Files:

[Number of Sparse Labels] ~~is an optional keyword describes describing~~ how many data pairs will appear for each frequency in [Network Data], and how many integer-labels will appear under the [Sparse Matrix Mapping] keyword. ~~(Need to add words under [Network Data] keyword to reflect this.)~~

Note that, if [Number of Sparse Labels] is present, the number of entries under [Network Data] does NOT need to match the size of a matrix given by [Number of Ports] x [Number of Ports]. Instead, the number of ~~integer-labels~~data pairs under the [Network Data] keyword must match the number of ~~colon-separated-groups~~integer-labels under the [Sparse Matrix Mapping] keyword.

[Number of Sparse Labels] is required if [Sparse Matrix Mapping] is present. Otherwise, it is prohibited.

[Number of Sparse Labels] accepts a single integer argument with value greater than zero. The value must match the number of integer-labels used under [Sparse Matrix Mapping]. The argument may appear immediately after the keyword, or may ~~they may~~ be separated from the keyword by a line termination sequence.

[Number of Sparse Labels] shall appear after the [Number of Ports] keyword and before any network data.

[Sparse Matrix Mapping]

Rules for Version 1.0-2.0 files:

[Sparse Matrix Mapping] is not permitted in Version 1.0-2.0 files.

Rules for Version 2.1 files:

[Sparse Matrix Mapping] is an optional keyword describing how the data under [Network Data] maps into the n-port matrix (n ~~by-x~~n, where n is given by [Number of Ports]).

[Sparse Matrix Mapping] shall appear after the [Number of Ports] keyword and before any network data. The [Network Data] keyword data given later in the file changes in meaning from expressing data ~~in a full~~ for an $n \times n$ matrix to expressing the data points remapped into the ~~full $n \times n$~~ matrix by the contents of the [Sparse Matrix Mapping] keyword.

[Sparse Matrix Mapping] contains two kinds of arguments: integer-labels and index-pairs. Integer-labels are integer numbers greater than or equal to 1 and less than or equal to n^2 . ~~Each integer-label is,~~ followed by the colon character without any whitespace. ~~All index-pairs after an integer-label and before the next integer-label or the end of [Sparse Matrix Mapping] refer to the data-pair under [Network Data] corresponding to the first integer-label and therefore force the corresponding entries in the full matrix to be identical.~~

An index-pair is a pair of positive integers between 1 and n , separated without any space by the comma character and enclosed, without whitespace, by parentheses. An index-pair specifies the row and column index in the n -port matrix ~~mapped~~ into which the [Network Data] is mapped by [Sparse Matrix Mapping]. All index-pairs after an integer-label and before the next integer-label or the end of [Sparse Matrix Mapping] refer to the data pair under [Network Data] corresponding to the first integer-label and therefore force the corresponding entries in the full $n \times n$ matrix to be identical.

Integer-labels are required if [Sparse Matrix Mapping] is present, must be numerically increasing and the sequence must begin with 1.

Integer-labels may not be re-used. Index-pairs may not be duplicated either within an integer-label group or between two or more integer-label groups.

The last integer-label shall be the same as the [Number of Sparse Labels].

White space is not permitted between the integer-label's integer value and the colon character.

In each index-pair, the row index is always the first integer and the column index is always the second. Zero values are not permitted within an index-pair. The value for any row or column index in an index-pair must be no larger than the [Number of Ports] argument.

For example, if the very first index-pair under [Sparse Matrix Mapping] is (1,5) and the first ~~row and column indices~~ data pair -of- under [Network Data] contain-is the real/imaginary pair 7 -0.8, then the values 7 -0.8 are assumed to occupy row 1, column 5 of the n -port matrix described by [Number of Ports].

The row and column indices in an index-pair are separated by a comma, are preceded by an open parenthesis and followed by a close parenthesis.

White space is not permitted after the open parenthesis and before the closed parenthesis of an index-pair. White space is required between index-pairs.

Data in the n-port matrix that is not indicated by a ~~matrix-n index~~-pair under [Sparse Matrix Mapping] is assumed to be zero-valued, corresponding to a value with zero real and zero imaginary part, regardless of the data format applied in the [Network Data] section. ~~For data in MA or RI format, a zero-valued pair is 0 0. As data in DB format cannot take on a zero value, DB format is assumed to apply only to the matrix data provided under [Sparse Matrix Mapping].~~

[Sparse Matrix Mapping] assumes that the matrix mapping between its entries and those of [Network Data] are unchanged apply across all frequency points given under [Network Data].

Multiple integer-labels may appear on the same line. Integer-labels and associated index-pairs may be separated by a line-termination sequence. Empty integer-labels (integer-labels followed by other integer-labels without an intervening index-pair) are not permitted.

[Sparse Matrix Mapping] must contain at least one integer-label. The number of integer-labels must agree with the argument used for [Number of Sparse Labels].

Lists of index-pairs may span multiple lines.

The maximum number of index-pairs under [Sparse Matrix Mapping] is given by the square of the argument to [Number of Ports].

Note that [Mixed-Mode Order], [Matrix Format], [Reference Impedance] and [Number of Ports] rules do not change in the presence of [Number of Sparse Labels]. [Mixed-Mode Order], [Matrix Format] and [Reference Impedance] describe the matrix populated by the contents of [Sparse Matrix Mapping] and [Network Data]. [Number of Ports] describes the matrix into which [Sparse Matrix Mapping] arguments map the data under [Network Data].

When [Matrix Format] is “Upper” then the row index of any index-pair must be less than or equal to column index of that pair. Similarly, when [Matrix Format] is “Lower” then the row index of any index-pair must be greater than or equal to the column index of that pair. For either “Upper” or “Lower” [Matrix Format], the number of index-pairs shall not exceed $0.5*(n^2 + n)$, where n is the number of ports given by [Number of Ports].

Example xx (Version 2.0):

```
[Version] 2.0  
# GHz S M A R 50  
[Number of Ports] 4
```

[Number of Frequencies] 1
[Reference] 50 75 0.01 0.01
[Matrix Format] Full
[Number of Sparse Labels]

~~43~~

[Sparse Matrix Mapping]

1: (1,1) (2,2) (1,3) (3,3) (4,4) - 2: (3,1) (4,2) - 3: (4,1) (2,1) (3,2) (4,3)

~~[End of Sparse Matrix Mapping]~~

[Network Data]

5.00000 0.60 161.24 ~~0.42 -66.58~~ 0.40 -42.20 ~~0.60 161.24~~ 0.42 -66.58

[End]

This describes the 4x4 matrix shown below:

0.60 161.24	0.42 -66.58	<u>0.40 -42.20</u>	0.60 161.24
0.42 -66.58	0.60 161.24	0.42 -66.58	<u>0.40 -42.20</u>
<u>0.40 -42.20</u>	0.42 -66.58	0.60 161.24	0.42 -66.58
0.42 -66.58	<u>0.40 -42.20</u>	0.42 -66.58	0.60 161.24

~~Other equivalent~~ The representation below is also permitted:s

[Sparse Matrix Mapping]

1: (1,1) (2,2) (1,3) (3,3) (4,4)

2: (3,1) (4,2)

3: (4,1) (2,1) (4,3) (1,4)

4: (2,1) (3,2) (4,3)

~~[End of Sparse Matrix Mapping]~~

[Network Data]

...

~~[Sparse Matrix Mapping]~~

~~1:~~

~~(1,1) (2,2) (3,3) (4,4)~~

~~2:~~

~~(3,1) (4,2)~~

~~3:~~

~~(4,1)~~

~~4:~~

~~(2,1) (3,2) (4,3)~~

~~[End of Sparse Matrix Mapping]~~

[Network Data]

[Sparse Matrix Mapping]

1:-

~~(1,1)~~

~~(2,2)~~

~~(3,3)~~

~~(4,4)~~

2:-

~~(3,1)~~

~~(4,2)~~

3:-

~~(4,1)~~

4:-

~~(4,1)~~

~~(2,1)~~

~~(3,2)~~

~~(4,3)~~

[End of Sparse Matrix Mapping]

[Network Data]

...

Example xx (Version 2.0):

[Version] 2.0

GHz S M A R 50

[Number of Ports] 4

[Number of Frequencies] 1

[Reference] 50 75 0.01 0.01

[Matrix Format] Lower

[Number of Sparse Labels]

4

[Sparse Matrix Mapping]

1: (1,1) (2,2) (3,3) (4,4) 2: (3,1) (4,2) 3: (2,1) (3,2) (4,3) 4: (4,1)

[Network Data]

5.00000 0.60 161.24 0.40 -42.20 0.42 -66.58 0.38 -20.03

[End]

This describes the 4x4 lower-half matrix shown below:

0.60 161.24

0.42 -66.58 0.60 161.24

0.40 -42.20 0.42 -66.58 0.60 161.24

0.38 -20.03 0.40 -42.20 0.42 -66.58 0.60 161.24

The representation below is also permitted

[Sparse Matrix Mapping]

1: (1,1) (2,2) (3,3) (4,4)

2: (3,1) (4,2)

3: (2,1) (3,2) (4,3)

4: (4,1)

[Network Data]

...

[End of Sparse Matrix Mapping]

~~Rules for Version 1.0-2.0 Files:~~

~~[End of Sparse Matrix Mapping] is not permitted in Version 1.0-2.0 files.~~

~~Rules for Version 2.1 Files:~~

~~[End of Sparse Matrix Mapping] is a keyword denoting the end of the Sparse Matrix data section. [End of Sparse Matrix Mapping] is required if [Sparse Matrix Mapping] is present.~~