

Sparse Matrix Mapping Draft 11

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[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 whose argument specifies how many data pairs will appear for each frequency argument of [Network Data]. This same number of sparse-label arguments shall exist for [Sparse Matrix Mapping].

[Number of Sparse Labels] requires a positive integer argument. The keyword and argument must be separated by whitespace.

If [Matrix Format] is not present or its argument is “Full” the argument value for [Number of Sparse Labels] shall not exceed n^2 , where n is the argument of [Number of Ports]. For [Matrix Format] arguments of “Upper” or “Lower” the argument of [Number of Sparse Labels] shall not exceed $(n^2 + n)/2$.

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

When present, [Number of Sparse Labels] shall appear after [Number of Ports] and before both [Network Data] and [Sparse Matrix Mapping].

[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 whose arguments describe how the data pairs of [Network Data] map into the n -port matrix, where n is the argument of [Number of Ports].

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

[Sparse Matrix Mapping] requires two types of arguments: sparse-labels and index-pairs. [Sparse Matrix Mapping] and its arguments may span multiple lines.

A sparse-label is a string of one or more ASCII characters. The last character of this string shall be the colon character ':'. The colon character may not appear in the string other than as the last character. A sparse-label shall not begin with an open parenthesis '(', though this character may be present for any character other than the first or last in the string. A sparse-label may consist of only the colon character - a one character string ":".

One or more sparse-labels are required if [Sparse Matrix Mapping] is present. Each sparse-label must be followed by a group of one or more index-pairs before the next sparse-label or end of [Sparse Matrix Mapping].

An index-pair is a pair of positive integers each between 1 and n, separated without whitespace by a comma and enclosed without whitespace by parentheses – of the form (i,j). An index-pair references an element in the n-port matrix. The first integer is the element's row index and the second integer is the element's column index.

Index-pairs occur in groups of one or more. Each group of index-pairs shall be preceded by a sparse-label. Whitespace must separate the sparse-label from the first index-pair of the group. Whitespace must also exist between index-pairs in the group. Whitespace must separate the last index-pair in a group from the next sparse-label, if any.

A group of index-pairs specifies the row and column indices for a group of elements in the n-port matrix into which the corresponding data pair of [Network Data] is mapped. Therefore, all matrix elements represented by the group of index-pairs have identical numerical values.

Each unique index-pair may not occur more than once in [Sparse Matrix Mapping].

Matrix elements whose corresponding index-pairs do not occur in [Sparse Matrix Mapping] are assumed to be zero-valued, corresponding to a value with zero real and zero imaginary part. This zero-value is independent of the data pair format specified in the options line.

The mapping defined by [Sparse Matrix Mapping] is identical for every frequency argument of [Network Data]. The number of data pairs for each frequency is defined by the argument of [Number of Sparse Labels].

Multiple sparse-labels may appear on the same line. A sparse-label may be separated from its associated group of index-pairs by a line termination sequence. A group of index-pairs may span multiple lines because index-pairs may be separated by a line-termination sequence.

For [Matrix Format] argument of "Upper" the first integer of all index-pairs must be less than or equal to the second integer of that pair. For [Matrix Format] argument of "Lower" the first integer of all index-pairs must be greater than or equal to the second integer of that pair.

The application of [Mixed-Mode Order], [Matrix Format], [Reference Impedance] and [Number of Ports] rules do not change in the presence of [Number of Sparse Labels] and [Sparse Matrix Mapping]. Each of these four keywords describes the n-port matrix populated by the contents of [Network Data] using the mapping defined by [Sparse Matrix Mapping]. [Number of Ports] describes the n-port matrix into which [Sparse Matrix Mapping] arguments map the data under [Network Data].

When present, [Sparse Matrix Mapping] shall appear after [Number of Ports], [Matrix Format] and [Number of Sparse Labels]. [Sparse Matrix Mapping] must appear before [Network Data].

Example XX (Version 2.0):

```
[Version] 2.0
# GHz S MA R 50
[Number of Ports] 4
[Number of Frequencies] 1
[Reference] 50 75 0.01 0.01
[Matrix Format] Full
[Number of Sparse Labels] 3
[Sparse Matrix Mapping]
1: (1,1) (2,2) (1,3) (3,3) (4,4) 2: (3,1) 3: (4,1) (2,1) (1,4) (4,3)
[Network Data]
5.000 0.60 161.24 0.40 -42.20 0.42 -66.58
[End]
```

This describes the following 4x4 matrix:

```
0.60 161.24 0.00 0.00 0.60 161.24 0.42 -66.58
0.42 -66.58 0.60 161.24 0.00 0.00 0.00 0.00
0.42 -66.58 0.00 0.00 0.60 161.24 0.00 0.00
0.42 -66.58 0.00 0.00 0.42 -66.58 0.60 161.24
```

The representation below is the same as the above:

```
[Sparse Matrix Mapping]
1: (1,1) (2,2) (1,3) (3,3) (4,4)
2: (3,1)
3: (4,1) (2,1) (4,3) (1,4)
```

The representation below is also the same as those above:

```
[Sparse Matrix Mapping]
: (1,1) (2,2) (1,3) (3,3) (4,4) : (3,1) : (4,1) (2,1) (4,3) (1,4)
```

Example YY (Version 2.0):

```
[Version] 2.0
# GHz S MA 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]
a: (1,1) (2,2) (3,3) (4,4) b: (3,1) (4,2) c: (2,1) (3,2) (4,3) d: (4,1)
```

```
[Network Data]
5.000  0.60 161.24  0.40 -42.20  0.42 -66.58  0.38 -20.03
[End]
```

This describes the following 4x4 lower-half matrix:

```
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 the same as the above:

```
[Sparse Matrix Mapping]
label_1 : (1,1) (2,2) (3,3) (4,4)
label_2 : (3,1) (4,2)
label_3 : (2,1) (3,2) (4,3)
label_4 : (4,1)
```

Example ZZ (Version 2.0):

```
! Two diff pair thru lines, no mode conversion.
! Ignore diff mode crosstalk, consider common mode crosstalk.
[Version] 2.0
# GHz S MA R 50
[Number of Ports] 8
[Mixed Mode Order] D1,2 D3,4 D5,6 D7,8 C1,2 C3,4 C5,6 C7,8
[Number of Frequencies] 1
[Matrix Format] Lower
[Number of Sparse Labels] 6
[Sparse Matrix Mapping]
Rdd: (1,1) (2,2) (3,3) (4,4)
Tdd: (3,1) (4,2)
Rcc: (5,5) (6,6) (7,7) (8,8)
Tcc: (7,5) (8,6)
NEXTcc: (6,5) (8,7)
FEXTcc: (7,6) (8,5)
[Network Data]
5.000  0.1 -75  0.9 -46  0.2 116  0.8 -63  0.1 14  0.3 82
[End]
```

This describes the following 8x8 lower-half matrix:

```
0.1 -75
0.0  0  0.1 -75
0.9 -46  0.0  0  0.1 -75
0.0  0  0.9 -46  0.0  0  0.1 -75
0.0  0  0.0  0  0.0  0  0.0  0  0.2 116
0.0  0  0.0  0  0.0  0  0.0  0  0.1 14  0.2 116
0.0  0  0.0  0  0.0  0  0.0  0  0.8 -63  0.3 82  0.2 116
0.0  0  0.0  0  0.0  0  0.0  0  0.3 82  0.8 -63  0.1 14  0.2 116
```