

## Structure of data sd\_macr\_elem\_dyna

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### Summary:

The structure of data sd\_macr\_elem\_dyna contains the projection of the matrices of rigidity, mass and possibly of damping of a substructure on a beforehand definite basis.  
It also contains the projection of the loading if one applies a loading to the substructure.

That structure of data is used for calculations of dynamic under-structuring. The dynamic macronutrient creates can also be used as super-mesh in a mixed model.

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## 1 General information

The structure of data `sd_macr_elem_dyna` contains the projection of the matrices of rigidity, mass and possibly of damping of a substructure on a beforehand selected basis.

It also contains the projection of the loading if one applies a loading to the substructure.

A structure of data `sd_nume_ddl` is attached to the structure of data `sd_macr_elem_dyna`. One referred there for the fictitious classification of the basic vectors of projection.

In order to ensure compatibility with `sd_macr_elem_stat`, data are repeated in various objects of the structure of data.

This structure of data is used in calculations of dynamic under-structuring or calculations with a mixed modeling. In this case, the dynamic macronutrient is used as super-mesh of the model.

## 2 Tree structure of the Structure of Data

```
sd_macr_elem_dyna (K8):: = record

    % description of the dynamic substructure
    ♦      \.DESM'           :   OJB   S   V   I
    ♦      \.REFM'           :   OJB   S   V   K8
    ♦      \.CONX'           :   OJB   S   V   I
    ♦      \.LINO'           :   OJB   S   V   I
    ♦      \.MAEL_DESC'      :   OJB   S   V   I
    ♦      \.MAEL_REFE'      :   OJB   S   V   K24
    % description of the loadings
    ◇      \.LICH'           :   OJB   XC  V   K8  NO
    ◇      \.LICA'           :   OJB   XD  V   R   NO
    % projected rigidity
    ♦      \.MAEL_RAID_DESC' :   OJB   S   V   I
    ♦      \.MAEL_RAID_REFE' :   OJB   S   V   K24
    ♦      \.MAEL_RAID_VALE' :   OJB   S   V   R or C
    % masses projected
    ♦      \.MAEL_MASS_DESC' :   OJB   S   V   I
    ♦      \.MAEL_MASS_REFE' :   OJB   S   V   K24
    ♦      \.MAEL_MASS_VALE' :   OJB   S   V   R
    % damping project
    ◇      \.MAEL_AMOR_DESC' :   OJB   S   V   I
    ◇      \.MAEL_AMOR_REFE' :   OJB   S   V   K24
    ◇      \.MAEL_AMOR_VALE' :   OJB   S   V   R
    % inertias following DX, DY and DZ
    ◇      \.MAEL_INER_REFE' :   OJB   S   V   K24
    ◇      \.MAEL_INER_VALE' :   OJB   S   V   R
    % classification of the basic vectors
    ♦      \$.VIDE'          :   sd_nume_ddl
```

## 3 Contents of the objects

### 3.1 Object `.DESM`

```
\.DESM'           :   OJB   S   V   I   length = 10
  DESM (1) : 0
  DESM (2) : nbnstc (many nodes used for the classification of the basic vectors)
  DESM (3) : many internal nodes of the substructure
```

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DESM (4) : nbvect (many basic vectors)  
DESM (5) : 0  
DESM (6) : 0  
DESM (7) : many loadings  
DESM (8) with DESM (10) : 0

## 3.2 Object .REFM

```
\.REFM'           :  OJB   S   V   K8   length = 8
  REFM (1) : name of the model
  REFM (2) : name of the grid
  REFM (3) : field material
  REFM (4) : elementary characteristics
  REFM (5) : name of the dynamic macronutrient
  REFM (6) : 'OUI_RIGI'
  REFM (7) : 'OUI_MASS'
  REFM (8) : 'OUI_AMOR' / 'NON_AMOR'
```

## 3.3 Object .LINO

```
\.LINO'           :  OJB   S   V   I   length = nbnstc
```

List of the numbers of the nodes used for the classification of the basic vectors

## 3.4 Object .CONX

```
\.CONX'           :  OJB   S   V   I   length = 3*nbnstc
```

For I varying 1 with nbnstc :

```
CONX (3* (i-1) +1) : 1
CONX (3* (i-1) +2) : LINO (I)
CONX (3* (i-1) +3) : 0
```

...

## 3.5 Object .MAEL\_DESC

```
\.MAEL_DESC'      :  OJB   S   V   I   length = 3
MAEL_DESC (1) : many coded entreties necessary to the size DEPL_R
MAEL_DESC (2) : component count maximum for the size DEPL_R
MAEL_DESC (3) : number of the size DEPL_R in the catalogue of the sizes
```

## 3.6 Object .MAEL\_REFE

```
\.MAEL_REFE'      :  OJB   S   V   K24  length = 2
MAEL_REFE (1) : name of the base of projection  $\Phi$ 
MAEL_REFE (2) : name of the grid
```

## 3.7 Object .LICH

This object is created only if one applies a loading to the substructure.

```
\.LICH'           :  OJB   XC  V   K8  NO
```

This collection contains the names of the loadings.

LICH (I) is of dimension 2.

In the case of load number I, one a:

LICH (I) (1) : 'NON\_SUIV'

LICH (I) (2) : name of the generalized loading  $F_i$

## 3.8 Object .LICA

This object is created only if one applies a loading to the substructure.

`.LICA' : OJB XD V R NO

This collection contains the generalized coordinates of the loadings.

LICA (I) is of dimension  $2*nbvect$

Each object is made of two end to end stored identical segments.

In each segment, one finds the loadings generalized:  $f_i = \Phi^T F_i$

## 3.9 Object .MAEL\_RAID\_DESC

`.MAEL\_RAID\_DESC' : OJB S V I length = 3

MAEL\_RAID\_DESC (1) : 2

MAEL\_RAID\_DESC (2) : nbvect

MAEL\_RAID\_DESC (3) : 2

## 3.10 Object .MAEL\_RAID\_REFE

`.MAEL\_RAID\_REFE' : OJB S V K24 length = 2

MAEL\_RAID\_REFE (1) : name of the base of projection  $\Phi$

MAEL\_RAID\_REFE (2) : vacuum if one exploits the matrix of impedance of the ground, or the name of the matrix of rigidity  $K$  to project

## 3.11 Object .MAEL\_RAID\_VALE

`.MAEL\_RAID\_VALE' : OJB S V R or C length = nbvect\* (nbvect+1)/2

This object contains the matrix of projected rigidity  $\tilde{K} = \Phi^T K \Phi$

This matrix is symmetrical, one stores only the higher triangular block.

## 3.12 Object .MAEL\_MASS\_DESC

`.MAEL\_MASS\_DESC' : OJB S V I length = 3

MAEL\_MASS\_DESC (1) : 2

MAEL\_MASS\_DESC (2) : nbvect

MAEL\_MASS\_DESC (3) : 2

## 3.13 Object .MAEL\_MASS\_REFE

`.MAEL\_MASS\_REFE' : OJB S V K24 length = 2

MAEL\_MASS\_REFE (1) : name of the base of projection  $\Phi$

MAEL\_MASS\_REFE (2) : vacuum or name of the matrix of mass  $M$  to project

### 3.14 Object .MAEL\_MASS\_VALE

\.MAEL\_MASS\_VALE' : OJB S V R length = nbvect\* (nbvect+1)/2

This object contains the matrix of projected mass  $\tilde{M} = \Phi^T M \Phi$

Only the higher triangular block is stored.

### 3.15 Object .MAEL\_AMOR\_DESC

\.MAEL\_AMOR\_DESC' : OJB S V I length = 3  
MAEL\_AMOR\_DESC (1) : 2  
MAEL\_AMOR\_DESC (2) : nbvect  
MAEL\_AMOR\_DESC (3) : 2

### 3.16 Object .MAEL\_AMOR\_REFE

\.MAEL\_AMOR\_REFE' : OJB S V K24 length = 2  
MAEL\_AMOR\_REFE (1) : name of the base of projection  $\Phi$   
MAEL\_AMOR\_REFE (2) : vacuum or the name of the matrix of damping  $C$  to project

### 3.17 Object .MAEL\_AMOR\_VALE

\.MAEL\_AMOR\_VALE' : OJB S V R length = nbvect\* (nbvect+1)/2

This object contains the terms of the matrix of damping projected (triangular higher)

$$\tilde{C} = \Phi^T C \Phi$$

If the user provides the generalized depreciation associated with the dynamic modes, the diagonal terms of this matrix contain provided depreciation.

### 3.18 Object .MAEL\_INER\_REFE

This object is not creates if the matrix of impedance of the ground is exploited.

\.MAEL\_INER\_REFE' : OJB S V K24 length = 2  
MAEL\_INER\_REFE (1) : name of the base of projection  $\Phi$   
MAEL\_INER\_REFE (2) : name of the matrix of inertia  $M$  used for the calculation of inertias

### 3.19 Object .MAEL\_INER\_VALE

This object is not creates if the matrix of impedance of the ground is exploited.

\.MAEL\_INER\_VALE' : OJB S V R length = 3\*nbvect

This object contains inertias along the axes DX, DY and DZ

MAEL\_INER\_VALE (1) with MAEL\_INER\_VALE (nbvect) : inertia according to DX  
where: MAEL\_INER\_VALE (I) :  $(L_x \Phi_i)^T M (L_x \Phi_i)$

MAEL\_INER\_VALE (nbvect+1) with MAEL\_INER\_VALE (2\*nbvect) : inertia according to DY

where: MAEL\_INER\_VALE (nbvect+i) :  $(L_y \Phi_i)^T M (L_y \Phi_i)$

MAEL\_INER\_VALE (2\*nbvect+1) with MAEL\_INER\_VALE (3\*nbvect) : inertia according to DZ  
where: MAEL\_INER\_VALE (2\*nbvect+i) :  $(L_z \Phi_i)^T M (L_z \Phi_i)$

$L_x$  indicate a matrix of localization of which the columns are made up of 1 on the ddl DX and 0 elsewhere.

$L_y$  indicate a matrix of localization of which the columns are made up of 1 on the ddl DY and 0 elsewhere.

$L_z$  indicate a matrix of localization of which the columns are made up of 1 on the ddl DZ and 0 elsewhere.

$\Phi_i$  indicate the 2rd vector of the base of projection.

## 3.20 Classification of the basic vectors

A structure of data sd\_numd\_ddl is attached to the structure of data sd\_macr\_elem\_dyna. One refers to it for the classification of the basic vectors.