Operator REST_GENE_PHYS

1 Goal

To restore in the physical base of the results in generalized coordinates.

This operator allows to restore in the physical space of the results got on a frame of reference generalized by methods of modal recombination.

The produced concept is a concept of the type:

- dyna_trans if the generalized results come from a calculation by modal recombination or following the extrapolation of experimental results of measurement on a digital model (the concept of entry is of type tran_gene),
- mode_meca for the restitution following a modal calculation with projection on a modal basis (the concept among is of mode_gene type),
- dyna_harmo for the restitution following a harmonic calculation with projection on a modal basis, without under-structuring (the concept among is of type harm_gene).

2 Syntax

```
resphy  = REST_GENE_PHYS   (                                        [*]
             ♦  RESU_GENE =  tg,                          /         [tran_gene]
                                                          /         [mode_gene]
                                                          /         [harm_gene]

             ◊  MODE_MECA =  mode,                                  [mode_meca]
             ◊  NUME_DDL =   numeddl,                               [nume_ddl]
              ◊ /  TOUT_ORDRE   =  'YES',
                / NUME_MODE    =  num,                             [l_I]
                /  NUME_ORDRE   =  num,                            [l_I]
                /  TOUT_INST    =  'YES',
                /  LIST_INST    =  list,                           [listr8]
                /  INST         =  inst,                           [l_R]
                /  FREQ         =  freq,                           [l_R]
                /  LIST_FREQ =  list,                              [listr8]
             ◊  /  TOUT_CHAM =  'YES',
                /  NOM_CHAM  =  (  |  'DEPL',
                                   |  'QUICKLY',
                                   |  'ACCE',                      [DEFECT]
                                   |  'ACCE_ABSOLU',
                                   |  'EFGE_ELNO',
                                   |  'SIPO_ELNO',
                                   |  'SIGM_ELNO',
                                   |  'FORC_NODA',),
             ◊  Interpol =   /  'FLAX',
                             /  'NOT',                             [DEFECT]
             ◊  CRITERION =  /  'ABSOLUTE',
                          /  'RELATIVE,                               [DEFECT]
             ◊  PRECISION =  /  prec,                              [R]
                             /  1.E-06,                            [DEFECT]
             ◊  /  MULT_APPUI = /  'YES',
                                /  'NOT',                          [DEFECT]
                /  CORR_STAT =  /  'YES',
                                /  'NOT',                          [DEFECT]
             ◊  /  ACCE_MONO_APPUI =
                (gamma1, gamma2, gamma3),                          [function]
                /   DIRECTION =
(dx1, Dy1, dz1, dx2, dy2, dz2, dx3, dy3, dz3),                     [l_R]

              ◊  / GROUP_NO  = lgrno,                              [l_co]
                 /  GROUP_MA  = lgrma,                             [l_co]

             ◊  TITLE  =  title,                                   [l_Kn]

                                )
If RESU_GENE of type tran_gene then      [*] = dyna_trans
If RESU_GENE of type mode_gene then      [*] = mode_meca
If RESU_GENE of type harm_gene then      [*] = dyna_harmo
```

3 Operands

3.1 Operand RESU_GENE

♦ RESU_GENE = tg

/ concept of the type tran_gene containing for various moments of the vectors generalized of standard displacement, speed and acceleration. If the results come from the extrapolation of results of measurement on a digital model (order PROJ_MESU_MODAL), the generalized vectors are of standard displacement, strain and stress. In this case, the base of recombination is of type mode_meca.

/ concept of the type mode_gene containing the generalized vectors of the modes calculated following a projection on modal basis.

/ concept of the type harm_gene containing the vectors generalized of standard displacement, speed and acceleration of the harmonic answer of a structure calculated after a projection on a modal basis

3.2 Operand MODE_MECA

◊ MODE_MECA = mode

Concept of the type mode_meca containing a base of clean modes obtained by under - dynamic structuring.

This operand is used in the case of a restitution in the physical system of a transitory computation result carried out on modal basis calculated by dynamic under-structuring. The modal base contained in the concept mode_meca was obtained by the order REST_SOUS_STRUC [U4.63.32]. It is thus about a double restitution, after having made a double projection (cf example with [§4]).

3.3 Operand NUME_DDL

◊ NUME_DDL = numeddl

Concept of the type nume_ddl containing a classification corresponding to a scale model in the case of a calculation with dynamic condensation when the user wishes a restitution on the ddls pertaining to this scale model.

This operand thus makes it possible to obtain following the restitution a concept mode_meca who could be used thereafter for a calculation on the scale model (see CAS-test SDNV107A for example).

3.4 Operands TOUT_ORDRE/NUMÉRIQUE_ORDRE/NUMÉRIQUE_MODE/TOUT_INST/LIST_INST/INST

◊ / TOUT_ORDRE = 'YES'

To restore on all the modes of the concept mode_gene.

/ NUME_ORDRE = num

List of entireties containing the sequence numbers of the modes on which the restitution takes place.

/ NUME_MODE = num

List of entireties containing the numbers of the modes in the total spectrum on which the restitution takes place.

/ TOUT_INST = 'YES'

If one wishes to restore over every moment contained in the generalized result (tran_gene).

/ LIST_INST = list

List of real crescents of the type listr8 containing the moments for which one wishes to carry out the restitution.

/ INST = inst

List of real containing the moments over which the restitution takes place.

For a transitory calculation, one checks that the moments requested by the option LIST_INST are well in the field of definition of tran_gene.
The results at one unspecified moment can be obtained by linear interpolation between the two moments results of calculation actually contained by tran_gene.

3.5 Operands FREQ/LIST_FREQ

These operands are used in the case of a restitution on the basis of physical generalized harmonic calculation (harm_gene).

/ FREQ = freq

Frequency to which one wishes to restore harmonic calculation

/ LIST_FREQ = list

List of real containing the frequencies for which one wishes to carry out the restitution.

For each frequency indicated, one restores the fields obtained at the frequency of calculation nearest. There is no interpolation.

3.6 Operands TOUT_CHAM/NOM_CHAM

◊ / TOUT_CHAM = 'YES'

Allows to restore the fields of reference symbol DEPL, QUICKLY and ACCE contents in the generalized result (tran_gene, harm_gene).

/ NOM_CHAM = nomcha

List of the reference symbols of field which one wishes to restore: 'DEPL','QUICKLY','ACCE'and possibly if they were calculated, 'ACCE_ABSOLU', 'EFGE_ELNO', 'SIPO_ELNO', 'SIGM_ELNO' or 'FORC_NODA'.
Restitution of the fields 'EFGE_ELNO', 'SIPO_ELNO', 'SIGM_ELNO' and 'FORC_NODA' is possible in multi - supports.

3.7 Operand Interpol

◊ Interpol =

'FLAX': an interpolation is authorized between two moments; this interpolation is usable only between two moments of calculation, but can lead to errors if the two moments of filing [U4.53.21] are separated from a very long time with respect to the periods of the studied phenomena.

'NOT' : the restitution must be made stricto sensu.

3.8 Operands PRECISION/CRITERION

◊ PRECISION = prec

◊ CRITERION =

When Interpol is worth 'NOT' indicate with which precision the research of the moment to be restored must be done

'ABSOLUTE' : interval of research [Inst - prec, Inst + prec],

'RELATIVE' : interval of research [(1 - prec).Inst, (1 + prec) . Inst]
Inst being the moment of restitution.

3.9 Operand MULT_APPUI

After the transitory calculation of the generalized seismic answer of a structure, the user must indicate 'YES' under the keyword MULT_APPUI to restore displacements (and/or speeds and/or accelerations) absolute. If it does not specify anything, the operator restores the relative sizes.

3.10 Operands ACCE_MONO_APPUI and DIRECTION

◊ | ACCE_MONO_APPUI = (gamma1, gamma2, gamma3), [function]
| DIRECTION = (dx1, Dy1, dz1, dx2, dy2, dz2, dx3, dy3, dz3), [l_R]

After the calculation of the generalized seismic answer of an excited mono structure, the user indicates the name ofS accélérogrammeS imposedS (keyword ACCE_MONO_APPUI) **and** Lbe directionS earthquake (keyword DIRECTION) to restore absolute accelerations (accelerations only). If it does not specify anything, the operator restores the relative sizes.

Note:

It is possible to impose up to 3 accélérogrammeS under the keyword ACCE_MONO_APPUI. They DOIVennT being itS evenS that itux imposedS under the keyword FONC_MULT DU keyword factor EXCIT DE the order DYNA_VIBRATED.

3.11 Operand CORR_STAT

After the transitory calculation of the generalized seismic answer of a structure, provided that the user asked 'CORR_STAT' = 'YES' in DYNA_TRAN_MODAL, it can then restore displacements (and/or speeds and/or accelerations) with correction by the static modes of the truncation of the modal base. The user must indicate 'YES' under the keyword CORR_STAT. If it does not specify anything, the operator restores the sizes without static correction.

3.12 Operand GROUP_NO

◊ / GROUP_NO = lgrno
/ GROUP_MA = lgrma

After a transitory calculation of dynamics on modal basis, the user can restore fields kinematics on a part only of the nodes or meshs of the grid.
List of the groups of nodes/meshs corresponding to the places where the user wants to restore fields kinematics.

3.13 Operand TITLE

◊ TITLE = title

Title attached to the concept produced by this operator [U4.03.01].

4 Example: Restitution of a transitory computation result carried out on modal basis calculated by dynamic under-structuring: double restitution

Modal calculation on a generalized model: $\left(\bar{\mathbf{K}}-\bar{\mathbf{M}}\omega^2\right)\eta=0$

with $\bar{\mathbf{K}}=\begin{pmatrix}\bar{\mathbf{K}}_1 & & \\ & \bar{\mathbf{K}}_2 & \\ & & \ddots\end{pmatrix}$ and $\bar{\mathbf{M}}=\begin{pmatrix}\bar{\mathbf{M}}_1 & & \\ & \bar{\mathbf{M}}_2 & \\ & & \ddots\end{pmatrix}$ and equations of connection $\mathbf{L}\eta=\mathbf{0}$

```
modgene = CALC_MODES (MATR_RIGI = K̄ ,
                      MATR_MASS = M̄
                     )
```

A generalized modal base is obtained: the clean modes of the total structure are linear combinations of the clean modes of the substructures: it is on this generalized modal basis Φ that one projects the generalized assembled matrices (double projection).

$$\begin{aligned}\bar{\bar{\mathbf{K}}} &= \Phi^T\bar{\mathbf{K}}\Phi \quad \text{opérateur PROJ\_MATR\_BASE}\\ \bar{\bar{\mathbf{M}}} &= \Phi^T\bar{\mathbf{M}}\Phi\\ \bar{\bar{\mathbf{C}}} &= \Phi^T\bar{\mathbf{C}}\Phi\\ \bar{\bar{\mathbf{F}}}_{ext} &= \Phi^T\bar{\mathbf{F}}_{ext} \quad \text{opérateur PROJ\_VECT\_BASE}\end{aligned}$$

Transitory calculation on the modal basis Φ obtained by dynamic under-structuring.

```
trangen = DYNA_TRAN_MODAL    (  MASS_GENE = M̄̄ ,
                                RIGI_GENE = K̄̄ ,
                                AMOR_GENE = C̄̄ ,
                                EXCIT = _F (VECT_GENE = F̄̄ext ) )
```

Restitution of the modal base Φ in the initial physical system:

```
modmeca = REST_SOUS_STRUC (  RESU_GENE = modgene,
                             SKELETON = squel )
```

Restitution of transitory calculation in the initial physical system:

```
tran = REST_GENE_PHYS  (  RESU_GENE = trangen,
                          MODE_MECA = modmeca )
```