

## Operator POST\_DYNA\_MODAL

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### 1 Goal

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Post-to treat the results in generalized coordinates produced by DYNA\_TRAN\_MODAL. Two options are available: post treatment of nonthe linearities of shock or the relations effort-displacement. In the first case, one chooses a diagnosis of wear or a better knowledge of the shocks which have occurred during the transitory analysis. The contents of the produced table are printable on the file RESULT by the order IMPR\_TABLE [U4.91.03].

## 2 Syntax

```
table [table_sdaster] = POST_DYNA_MODAL_T (
    ♦ RESU_GENE = tg, [tran_gene]

    ♦ / SHOCK =_F (
        ◇ INST_INIT = -1.0, [DEFECT]
          / t0, [R]

        ◇ INST_FIN = /999. , [DEFECT]
          / T1, [R]

        ◇ NB_BLOC = /1, [DEFECT]
          / Nb, [I]

        ◇ SEUIL_FORCE = /0.0 [DEFECT]
          / S, [R]

        ◇ DUREE_REPOS = /0.0, [DEFECT]
          / D, [R]

        ◇ OPTION = / 'WEAR', [DEFECT]
          / 'IMPACT',

        ◇ NB_CLASSE = / 10, [DEFECT]
          / nc, [I]
    ),

    ◇ RELA_EFFO_DEPL =_F (
        ♦ NODE = noe, [node]
        ♦ NOM_CMP = noncmp, [K8]
    ),

    ◇ INFORMATION = / 1,
[DEFECT]
          / 2,

    ◇ TITLE = title, [l_Kn]
)
```

## 3 Operands

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### 3.1 Operand RESU\_GENE

◆ RESU\_GENE = tg

Result of a transitory calculation by modal recombination, produced by the operator DYNA\_TRAN\_MODAL [U4.53.21].

### 3.2 Keyword SHOCK

◇ SHOCK

Keyword factor allowing to specify that one wishes an analysis of the non-linearities of shock taken into account in modal transitory calculation.

#### 3.2.1 Operand INST\_INIT

◇ INST\_INIT = T<sub>0</sub>

Moment of beginning of the average of the signals and analysis of the shocks. By default T<sub>0</sub> corresponds to the first moment of transitory calculation by modal recombination.

#### 3.2.2 Operand INST\_FIN

◇ INST\_FIN = T<sub>1</sub>

Moment of end of the average of the signals and analysis of the shocks.  
(T<sub>1</sub> = 999. value by default),

#### 3.2.3 Operand NB\_BLOC

◇ NB\_BLOC = Nb

Many temporal blocks of division interval [T<sub>0</sub>, T<sub>1</sub>] for the average of the signals (1 by default).

The keyword is not used for the option 'IMPACT'.

#### 3.2.4 Operand SEUIL\_FORCE

◇ SEUIL\_FORCE = S

Threshold characterizing a phase of contact, (  $|f_n| > s \Rightarrow$  contact établi )

(S = 0. value by default).

#### 3.2.5 Operand DUREE\_REPOS

◇ DUREE\_REPOS = D

With D minimum duration of rest characterizing the end of a shock.

If one indicates per T<sub>c</sub> end of the shock then

$$\forall t \in [t_c, t_c + d] \rightarrow |f_n| < s$$

The duration of rest D is the minimum duration during which no contact on the node is recorded, in order to determine the end of an event of shock and its duration.

## 3.2.6 Operand OPTION

◇ OPTION = / 'WEAR'  
/ 'IMPACT'

This keyword makes it possible to choose between a postprocessing for a diagnosis of wear (keyword 'WEAR') or of a better knowledge of the possible shocks which have occurred during the transitory analysis (keyword 'IMPACT'). This last post treatment is adapted to the calculation of the interns of the power stations REFERENCE MARK to see [§4].

## 3.2.7 Operand NB\_CLASSE

◇ NB\_CLASSE = nc

Many classes which the user wants to distinguish during the development of the histogram describing maximum forces of impact. By default, nc = 10.

## 3.3 Keyword RELA\_EFFO\_DEPL

◇ RELA\_EFFO\_DEPL

Keyword factor allowing an analysis of the relations of non-linearity effort-displacement.

One files in the table result the name of the relation to the node observed, the moments of analysis and the maximum reached by the component observed during the analysis.

All the phases with nonlinear behavior are determined and one files in the table result for each one:

- the initial moment and the final moment of the interval of the nonlinear phase,
- the maximum reaches and the moment associated in this interval.

The parameters of the produced table are described in the following table:

PARAMETERS	TYPE	DESCRIPTION
RELATION	K8	name of relation to the node observed
NODE	K8	name of the treated node
CMP	K8	name of the component
PHASE	I	number of the phase
INST_INIT	R	initial moment of the interval of the nonlinear phase
INST_FIN	R	final moment of the interval of the nonlinear phase
MAXIMUM	R	maximum reached
INST_MAXI	R	moment associated to the maximum reached

### 3.3.1 Operand NODE

◇ NODE = noe

Name of the node of the structure on which the nonlinear relation to treat was defined.

### 3.3.2 Operand NOM\_CMP

◇ NOM\_CMP = noncmp

Name of the component treated with the node noe.

## 3.4 Operand INFORMATION

- ◇ INFORMATION = imp, level of the impressions
  - / 1 no impression on the file message (all is stored in the produced table)
  - / 2 impression amongst step of computing time

## 3.5 Operand TITLE

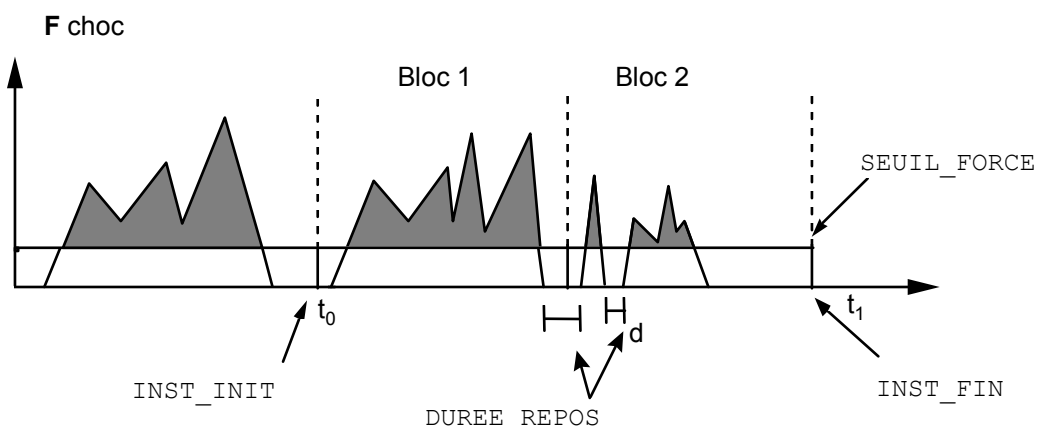
- ◇ TITLE = title
  - title is the title of calculation. It will be printed at the top of the results. It is stored in the concept table.

# 4 Checking - Execution

## 4.1 For the keyword factor SHOCK

The value of INST\_FIN is compared with the final moment  $t_f$  result tran\_gene. The value of INST\_FIN reserve is  $\min(t_f, t_1)$ .

If the value of INST\_INIT  $t_0$  is higher than the value of INST\_FIN, one stops in error.



Bloc 1 : 1 choc

Bloc 2 : 2 chocs

■ : signal pris en compte dans les statistiques

## 4.1.1 Execution with option 'IMPACT'

For each nonlinearity of shock, one calculates and one files in the table result:

- shocks and associated sizes:  
for each shock, one has the value of the moment when the force is maximum, the value of the maximum force and the impulse, duration of the shock, impact speed and the number of rebounds,
- total data of the shock:  
on the whole of the noted shocks, one specifies: the absolute maximum of force of shock, the median value of maximum of forces of shock and the standard deviation of the extrema of force of shocks,
- the histogram describing the max of the forces of impact:  
one has the number of classes of the histogram, the values of his X-coordinates (force min and max of each class) and the density of probability of the maximum force of each class.

## 4.1.2 Execution with the option 'WEAR'

For each nonlinearity of shock, one calculates and one files in the table result:

- the median values min, max, standard deviation, RMS of relative displacements of the nodes of shocks in their total reference mark,
- median values and RMS (over the time of shock and total time) like min and max of the normal and tangential forces of shock,
- the number of average shocks on each connection of shock, the time of average shock, the time of average rebound,
- power of average wear calculated within the meaning of ARCHARD [bib1]:

$$P_{\text{usure}} = \frac{1}{T} \cdot \int_0^T F_N(t) \cdot V_T(t) \cdot dt$$

## 4.2 For the keyword factor RELA\_EFFO\_DEPL

It is checked that the node `noeu` corresponds to a nonlinear relation.

One prints using the order `IMPR_TABLE` :

```
-----  
ASTER 4.03.15 CONCEPT TABLE CALCULATES THE 2/3/98 AT 12:08: 19 OF TYPE  
TABLE_SDASTER  
RELATION NODECMP PHASE INST_INIT INST_FIN MAXIMUM INST_MAXI  
NON LIN N100 DRY MARTINI 1 1.24000E+00 1.26600E+00 1.80716E-05  
1.25200E+00  
NON LIN N100 DRY MARTINI 2 2.02600E+00 2.09000E+00 -2.00433E-05  
2.05800E+00  
NON LIN N100 DRY MARTINI 3 3.00000E+00 3.04000E+00 -1.89110E-05  
3.02200E+00  
NON LIN N100 DRY MARTINI 4 3.10400E+00 3.20400E+00 3.50715E-05  
3.15400E+00  
NON LIN N100 DRY MARTINI 5 3.26000E+00 3.33600E+00 -2.91359E-05  
3.30000E+00  
NON LIN N100 DRY MARTINI 6 3.41400E+00 3.43200E+00 1.73099E-05  
3.42400E+00
```

# Code\_Aster

Version  
default

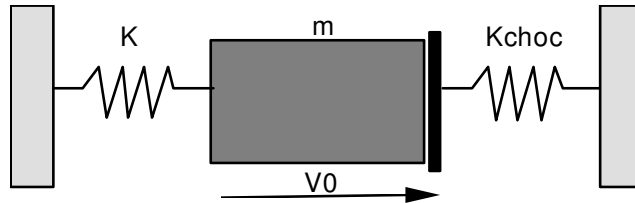
Titre : Opérateur POST\_DYNA\_MODA\_T  
Responsable : ANDRIAMBOLOLONA Harinaivo

Date : 03/02/2011 Page : 7/9  
Clé : U4.84.02 Révision :  
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## 5 Examples of use

### 5.1 Example with the option IMPACT : to launch of an oscillator with shock

Test SDND101 here is presented. It is a question of calculating the answer of a system mass-rides initial speed  $V_0$  nonworthless, being able to impact on a thrust with shock. The initial game is null.



One compares the values of the moments of maximum force, value of maximum force, duration of the time of shock, value of the impulse and impact speed as well as the number of elementary impacts for the first two oscillations of the system to the analytical values.

#### Command file

```

CONTINUATION ()
# the system mass-rides east releases with an initial speed V0
#
VITEPHYS = CREA_CHAMP (MAILLAGE= beam, TYPE_CHAM= 'NOEU_DEPL_R',
                      CHAM_NO = vectass,
                      AFFE= (TOUT= 'YES',
                              NOM_CMP= ('DX'),
                              VALE_R= V0 )
                      )
#
VITINI = PROJ_VECT_BASE ( BASE= MODES, VECT_ASSE= VITEPHYS,
                          NUME_DDL_GENE= NUMEGE,
                          TYPE_VECT= 'QUICKLY')
#
MASSEGEN = PROJ_MATR_BASE ( BASE= MODES,
                              NUME_DDL_GENE= NUMEGE,
                              MATR_ASSE= MATRMASS,
                              )
#
RIGIDGEN = PROJ_MATR_BASE ( BASE= MODES,
                              NUME_DDL_GENE= NUMEGE,
                              MATR_ASSE= MATRRIGI,
                              )
#
PLANZ = DEFI_OBSTACLE (TYPE= 'PLAN_Z')
PLANY = DEFI_OBSTACLE (TYPE= 'PLAN_Y')
#
DYNAMODA = DYNA_TRAN_MODAL ( METHOD = 'EULER',
                              MASSE_GENE = MASSEGEN,
                              RIGI_GENE = RIGIDGEN,
                              AMOR_REDUIT= 0. ,
                              ETAT_INIT= _F
                              )
(VITE_INIT_GENE=VITINI),
                              INCREMENT= _F ( INST_INIT= 0. ,
                                                INST_FIN= 0.5,
                                                PAS= 0.0005),

```



```
0.),  
  
CHOC= _F (0NOEUD_1= 'N01',  
          OBSTACLE= PLANZ,  
          ORIG_OBST= (- 1. , 0. ,  
  
          NORM_OBST= (0. 0. 1.),  
          JEU= 1.00,  
          RIGI_NOR= 1000000. ,  
          RIGI_TAN= 0. ,  
          COULOMB= 0.          )  
  
          )  
  
# Postprocessing of the efforts of shock  
  
All = POST_DYNA_MODAL ( RESU_GENE = DYNAMODA,  
                       CHOC= _F ( INST_INIT   = 0. ,  
                                INST_FIN     = 0,495,  
                                SEUIL_FORCE  = 0. ,  
                                DUREE_REPOS  = 0. ,  
                                OPTION       = 'IMPACT',  
                                NB_CLASSE    = 8          ),  
                       INFORMATION = 1  
                       )  
  
IMPR_TABLE ( TABLE = All,  
            FILTER = ( NOM_PARA= 'CALCULATION',  
                      VALE_K = 'TOTAL' ),  
            NOM_PARA= ( 'NODE', 'F_MAX_ABS', 'F_MAX_MOY',  
                      'F_MAX_ETYPE'      ) )
```

## 6 Bibliography

- 1) ARCHARD: The wear of metals under unlubricated conditions Proc-Roy-Ploughshare. (1956).