

## Operator POST\_DYNA\_MODAL

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### 1 Drank

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

## 2 Syntax

```
counts [table_sdaster] = POST_DYNA_MODA_T (
    ♦ RESU_GENE = tg, [tran_gene]
    ♦/CHOC =_F (
        [DEFAULT]
        ◊INST_INIT = -1.0, [R]
        /t0, [R]
        ◊INST_FIN =/999. , [DEFAULT]
        /T1, [R]
        ◊NB_BLOC =/1, [DEFAULT]
        /Nb, [I]
        ◊SEUIL_FORCE =/0.0 [DEFAULT]
        /S, [R]
        ◊DUREE_REPOS =/0.0, [DEFAULT]
        /D, [R]
        [DEFAULT]
        ◊OPTION =/"USURE",
        /"IMPACT",
        [DEFAULT]
        ◊NB_CLASSE =/10 ,
        /nc, [I]
    ),
    ◊RELA_EFFO_DEPL =_F (
        ♦ NOEUD = noeud, [node]
        ♦NOM_CMP = noncmp, [K8]
    ),
    [DEFAULT]
    ◊INFO =/1 ,
    /2 ,
    ◊TITER =titer , [l_Kn]
)
```

## 3 Operands

### 3.1 Operand RESU\_GENE

◇RESU\_GENE = tg

Result of a transient computation by modal recombination, DYNA\_TRAN\_MODAL [ U4.53.21 ] produces by the operator.

### 3.2 Key word CHOC

◇CHOC

Key word factor allowing to specify that one wishes an analysis of the non-linearities of shock taken into account in modal transient computation.

#### 3.2.1 Operand INST\_INIT

◇INST\_INIT = t0

Instant of beginning of the average of the signals and analysis of the shocks. By default t0 corresponds to the first transitory time of computation by modal recombination.

#### 3.2.2 Operand INST\_FIN

◇INST\_FIN = Urgent

T1 of end of the average of the signals and analysis of the shocks.  
(T1 = 999. default value),

#### 3.2.3 Operand NB\_BLOC

◇ NB\_BLOC = Nb

Many temporal blocks of division interval [t0, T1] for the average of the signals (1 per default).  
The key word is not used for the option "IMPACT".

#### 3.2.4 Operand SEUIL\_FORCE

◇SEUIL\_FORCE = S

Threshold characterizing a phase of contact, (  $|f_n| > s \Rightarrow \text{contact établi}$  )  
(S = 0. default value).

#### 3.2.5 Operand DUREE\_REPOS

◇DUREE\_REPOS = D

With D minimal period of rest characterizing the end of a shock.  
If one indicates by Tc the end of the shock then

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

the period 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 period.

## 3.2.6 Operand OPTION

◇OPTION = "USURE"  
/"IMPACT"

This key word makes it possible to choose between a postprocessing for a diagnosis of wear (key word "USURE") or of a better knowledge of the possible shocks which have occurred during the transient analysis (key word "IMPACT"). This last post processing is adapted to the computation of the interns of the power stations REFERENCE MARK to see [§4].

## 3.2.7 Operand NB\_CLASSE

◇NB\_CLASSE = nc

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

## 3.3 Key word RELA\_EFFO\_DEPL

◇RELA\_EFFO\_DEPL

Key word factor allowing an analysis of the relations of non-linearity force-displacement.

One result files in the array the name of the relation to the node observed, times 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 array result for each one:

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

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

PARAMETERS	TYPE	DESCRIPTION
RELATION	K8	name of relation to the node observed
NOEUD	K8	name of the node treated
CMP	K8	name of component
PHASE	I	initial number of
phase	INST_ INIT	R urgent of the interval of nonlinear phase
INST FIN	R	final moment of the interval of nonlinear phase
MAXI	R	maximum reaches
INST MAXI	R	urgent associated to the maximum reaches

### 3.3.1 Operand NOEUD

◆NOEUD = noeu

Name of the node of the structure on which the nonlinear relation with treating was defined.

### 3.3.2 Operand NOM\_CMP

◆NOM\_CMP = noncmp

Name of the component treated with the node noeu.

## 3.4 Operand INFO

◇INFO = imp, level from the printings

- /1 no printing on the message file (all is stored in the produced array)
- /2 printing amongst time step of computation

## 3.5 Operand TITER

◇TITER = title

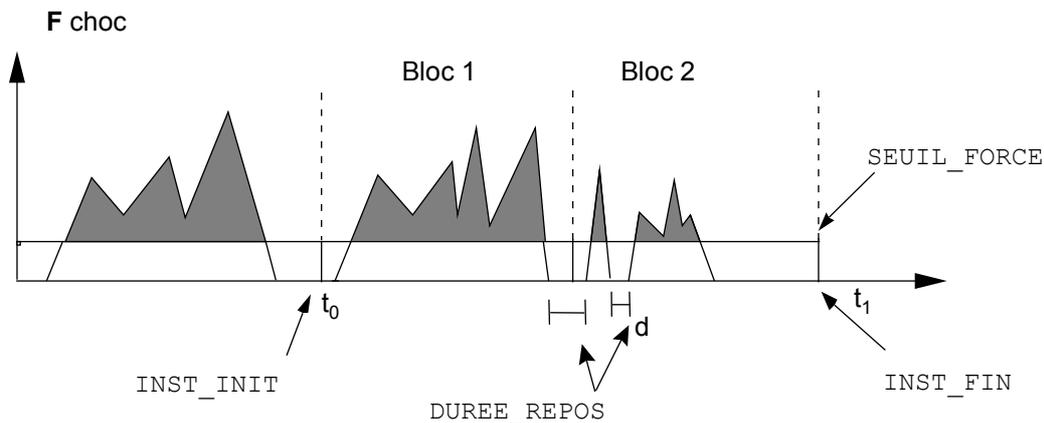
title is the title of computation. It will be printed at the top of the results. It is stored in the concept counts.

## 4 Checking - Execution

### 4.1 For the key word factor CHOC

the value of INST\_FIN is compared with final moment  $t_f$  result tran\_gene. The value of INST\_FIN retained 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 array result:

- shocks and associated quantities:  
for each shock, one has the value of time when the force is maximum, the value of the maximum force and the impulse, period of the shock, impact speed and the number of rebounds,
- total data of the shock:  
on all the noted shocks, one specifies: the absolute maximum of shock force, the mean value of maximum of shock forces and the standard deviation of the extrema of shock force,
- 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 option "USURE"

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

- the mean values min, max, standard deviation, RMS of relative displacements of the nodes of shocks in their total reference,
- mean values and RMS (over the time of shock and total time) like min and max of the normal forces and tangential 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 key word factor RELA\_EFFO\_DEPL

One checks that the node `noeu` corresponds to a nonlinear relation.

One prints using command `IMPR_TABLE` :

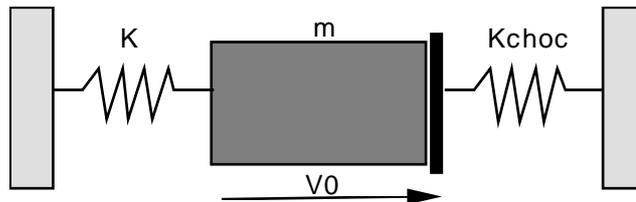
```
-----  
ASTER4.03.15CONCEPT      COUNTS CALCULE LE 2/3/98 A 12:08: 19 OF TYPE  
TABLE_SDASTER  
  
RELATIONNOEUDCMPHASEINST_INITINST_FIN      MAXIINST_MAXI  
  
NON_LINN100DRY      11.24000E+001.26600E+00  
1.80716E-051.25200E+00  
NON_LINN100DRY      22.02600E+002.09000E+00  
-2.00433E-052.05800E+00  
NON_LINN100DRY      33.00000E+003.04000E+00  
-1.89110E-053.02200E+00  
NON_LINN100DRY      43.10400E+003.20400E+00  
3.50715E-053.15400E+00  
NON_LINN100DRY      53.26000E+003.33600E+00  
-2.91359E-053.30000E+00  
NON_LINN100DRY      63.41400E+003.43200E+00  
1.73099E-053.42400E+00
```



## 5 Examples of Example

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

One presents test SDND101 here. It is a question of calculating the response of a spring-mass system non-zero initial  $V_0$  velocity, being able to impact on a thrust with shock. Initial clearance is null.



One compares the values of times of maximum force, value of maximum force, period 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

```
POURSUIITE ()
# the spring-mass system east releases with an initial velocity V0
#
VITEPHYS = CREA_CHAMP (MAILLAGE= beam, TYPE_CHAM= "NOEU_DEPL_R",
                      CHAM_NO = vectass,
                      AFFE= (TOUT= "OUI",
                              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 ( METHODE = "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= "NO1",  
          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 forces of shock  
  
TOUT =POST_DYNA_MODAL_T      ( RESU_GENE = DYNAMODA,  
                              CHOC=_F      ( INST_INIT=0      .,  
                                          INST_FIN=0.495      ,  
                                          SEUIL_FORCE=0      .,  
                                          DUREE_REPOS=0      .,  
                                          OPTION=' IMPACT',  
                                          NB_CLASSE=8  
                              ),  
  
                              INFO = 1  
                              )  
  
IMPR_TABLE ( ARRAY =TOUT ,  
             FILTRE = ( NOM_PARA= "CALCUL",  
                       VALE_K = "GLOBAL" ),  
             NOM_PARA= ( "NOEUD", "F_MAX_ABS", "F_MAX_MOY",  
                       "F_MAX_ETYPE" ) )
```

## 6 Bibliography

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