# Operator POST_K_TRANS

## 1 Goal

To calculate the factors of intensity of the constraints of a transitory dynamic problem solved by decomposition on a modal basis.

The calculation of the factors of intensity of the constraints, functions of time, is made starting from the factors of intensity constraints modal (resulting from CALC_G [U4.82.03]) and of the modal factors of contribution resulting from transitory dynamic calculation (operator DYNA_VIBRATED [U4.53.21]).

This operator can be called as well in 2D as in 3D. The crack can be with a grid or not-with a grid (crack X-FEM).

This operator is valid only if one can make a combination linear of the modal factors of intensity of the constraints. In particular, the crack must remain always open: the contact between the lips of this one is indeed not taken into account.

Product a structure of data of the type table_sd_aster.

# 2 Syntax

```
[table_sdaster] =   POST_K_TRANS

    # Transitory result
      ♦ RESU_TRANS = rtran  ,                          [tran_gene]

    # Parameters of calculation of K modal
      ♦ K_MODAL = _F (
              ♦ /  FOND_FISS   = bottom   ,             [fond_fiss]
                /  CRACK     = fiss ,              [fiss_xfem]

              ♦ /  TABL_K_MODA  = tablk   ,          [table_sdaster]

    # Parameters of selection of the moments of postprocessing
      ◊ /  TOUT_ORDRE   =  'YES',                      [DEFECT]
        /  NUME_ORDRE   =  l_ordre,                    [l_I]
        /  LIST_ORDRE   =  read   ,                       [listis]
        /  INST         =  l_inst,                     [l_R]
        /  LIST_INST    =  l_reel,                     [listr8]
      ◊ CRITERION =  /  'RELATIVE',                    [DEFECT]
                        ◊ PRECISION =  /  prec,        [R]
                                       /  1.E-6 ,      [DEFECT]
                     /  'ABSOLUTE',
                        ♦ PRECISION =  prec,           [R]


# Impression of information
      ◊ TITLE  =      title,                           [l_Kn]
      ◊ INFORMATION  =  /  1   ,                             [DEFECT]
                        /  2   ,
       )
```

# 3 Operands

## 3.1 Operand RESU_TRANS

Name of a concept result of the type tran_gene, result of transitory dynamic calculation.

## 3.2 Keyword K_MODAL

Keyword factor allowing to recover the modal factors of intensity of the constraints directly starting from the table TABL_K_MODA, result of the operator CALC_G.

### 3.2.1 Operands FOND_FISS/CRACK

It is obligatory to inform is FOND_FISS (produced by the order DEFI_FOND_FISS [U4.82.01] that is to say CRACK (produced by the order DEFI_FISS_XFEM [U4.82.08]).

### 3.2.2 Operand TABL_K_MODA

Table result containing the modal factors of intensity of the constraints, produced by the operator CALC_G (option CALC_K_G [U4.82.03]).

## 3.3 Operands TOUT_ORDRE/NUME_ORDRE/LIST_ORDRE/INST/LIST_INST/PRECISION/CRITERION

These operands are used to select the moments or sequence numbers of postprocessing of the operand RESU_TRANS. See [U4.71.00].

## 3.4 Operand TITLE

◊ TITLE = title

[U4.03.01].

## 3.5 Operand INFORMATION

◊ INFORMATION = /1, [DEFECT]
/2,

Level of messages in the file 'MESSAGE'.

# 4 Principle of calculation

Displacement $u(x,t)$ solution of a linear transitory dynamic problem can be approximate step its decomposition on a truncated basis of the clean modes $\Phi_i(x)$ :

$$u(x,t)=\sum_{i=1}^{M} \alpha_i(t)\Phi_i(x)$$

It is what is carried out for example when one deals with a transitory problem of dynamics with the operator DYNA_VIBRATED [U4.53.21]. In the same way, one can approach the modal factors of intensity of the constraints – with the same degree of accuracy on the result - by the following relation:

$$K_I(s,t)=\sum_{i=1}^{M} \alpha_i(t) K_I^i(s)$$

where them $\alpha_i(t)$ are the modal contributions, and $K_I^i(s)$ modal factors of intensity of the constraints (function of the curvilinear X-coordinate $s$ in 3D, constant in 2D). The modal factors of intensity of the constraints are calculated starting from the clean modes of the structure, by the option CALC_K_G of the operator CALC_G.

The contact not being taken into account, this formula is valid only if the crack remains open for any moment. It is generally the case for the applications of revolving the machines type (wings) considered, for which the centrifugal loading is dominating.

Thus, operations carried out by the operator POST_K_TRANS are the following ones:

- recovery in RESU_TRANS modal factors of participation $\alpha_i$ resulting from transitory calculation,
- recovery (in TABL_K_MODA) modal factors of intensity of the constraints,
- recombination and impression ofS dynamic stress intensity factors.

The number $M$ modes in the base of recombination corresponds, by default, with the number of modes $M^{trans}$ used in transitory calculation. If the number $M^{tabl}$ modes present in the table TABL_K_MODA provided as starter is lower than $M^{trans}$, a message of alarm is transmitted and calculation continues while taking $M$ equal to $M^{tabl}$.

# 5 Example

One treats here the case of a structure 3D subjected to a transitory dynamic loading (cf case test sdls114b [V2.03.114]). After construction of the matrices of masses and rigidity, one can calculate the clean modes of the structure:

```
MODE=CALC_MODES (MATR_RIGI=RIG_ASS,
                 MATR_MASS=MA_ASS,
                 CALC_FREQ=_F (NMAX_FREQ=60,),);
```

One can then calculate the displacement of the structure subjected to a dynamic loading:

```
 RES_DYNA=DYNA_VIBRA (TYPE_CALCUL=' TRAN', BASE_CALCUL=' GENE',
                      MATR_MASS=MASS_GE,
                      MATR_RIGI=RIGI_GE,
                      MATR_AMOR=AMOR_GE,
                      SCHEMA_TEMPS=_F (SCHEMA=' EULER',),
                      INCREMENT=_F (INST_INIT=0.,
                                    INST_FIN=tfin,
                                    VERI_PAS = 'YES',
                                    PAS=pas,),
                      EXCIT=_F (VECT_ASSE=CHA_ASS,
                                FONC_MULT=RAMPE,),
                      ARCHIVAGE=_F (PAS_ARCH = nbpas,),
                      IMPRESSION = _F (TOUT=' OUI',),);
```

Calculation in breaking process starts with the definition of the bottom of crack:

```
FF2=DEFI_FISS_XFEM (MODELE=MO,
         DEFI_FISS=_F (GROUP_MA_FISS=' LEV_SUP',
                       GROUP_MA_FOND=' FN_FS',),
         GROUP_MA_ENRI=' VVOLTOT',);
```

The calculation of the functions $K_I(t)$, $K_{II}(t)$ and $K_{III}(t)$ is done after the preliminary calculation of the modal factors of intensity of the constraints by CALC_G :

```
KT2 = POST_K_TRANS (   RESU_TRANS = RES_DYNA,
                    K_MODAL = _F (TABL_K_MODA =GLMO1,
                                  FISSURE=FF2,),);
```