Operator POST_K_TRANS

1 Drank

Compute the factors of intensity of the stresses of a problem transient dynamics solved by decomposition on a modal base.

The computation factors of intensity of the stresses, functions of time, is made starting from the factors of intensity stresses modal (resulting from CALC_G [U4.82.03]) and modal factors of contribution resulting from transient dynamic computation (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 NON-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 stresses. In particular, the crack must remain always open: the contact between the lips of this one is indeed not taken into account.

Product a data structure of the table_sd_aster type.

2 Syntax

```
[table_sdaster] =POST_K_TRANS

   #Résultat  transitory
      ♦RESU_TRANS    =rtran      ,                          [tran_gene]

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

                 ♦/TABL_K_MODA=           tablk ,           [table_sdaster]

   #Parameters    of selection of times of postprocessing
                     ◊/TOUT_ORDRE=' OUI',                      [DEFAULT]
          /NUME_ORDRE       =l_ordre ,                      [l_I]
          /LIST_ORDRE       =lis     ,                        [listis]
          /INST             =l_inst  ,                      [l_R]
          /LIST_INST           =l_reel  ,                     [listr8]
      ◊CRITERE=/              "RELATIF",                      [DEFAULT]
                           ◊PRECISION    =/prec      ,       [R]
                                           /1.E-6  ,   [DEFAULT]
                       /   "ABSOLU",
                           ♦PRECISION    =prec ,           [R]


#Impression    of information
       ◊TITER=titer            ,                            [l_Kn]
       ◊INFO=/1                ,                            [DEFAULT]
                    /2     ,
        )
```

3 Operands

3.1 Operand RESU_TRANS

Name of a result concept of the tran_gene type, result of transient dynamic computation.

3.2 Key word K_MODAL

Key word factor allowing to recover the modal factors of intensity of the stresses directly starting from table TABL_K_MODA, result of operator CALC_G.

3.2.1 Operands FOND_FISS/CRACK

It is compulsory to inform either FOND_FISS (produced by the command DEFI_FOND_FISS [U4.82.01] or CRACK (produced by the command DEFI_FISS_XFEM [U4.82.08]).

3.2.2 Operand TABL_K_MODA

Counts result containing the modal factors of intensity of the stresses, produces by the operator CALC_G (option CALC_K_G [U4.82.03]).

3.3 Operands TOUT_ORDRE/NUME_ORDRE/LIST_ORDRE/INST/LIST_INST/accuracy/CRITERE

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

3.4 Operand TITER

◊TITER=titer

[U4.03.01].

3.5 Operand INFO

◊INFO = /1, [DEFAULT]
/2,

Level of messages in the file "MESSAGE".

4 Principle of computation

solution $u(x,t)$ displacement of a linear problem transient dynamics can be approximate step its decomposition on a truncated basis of the eigen 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 problem of transient dynamics with operator DYNA_ VIBRATED [U4.53.21]. In the same way, one can approach the modal factors of intensity of the stresses – with the same degree of accuracy on result - by the following relation:

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

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

The contact not being taken into account, this formula is valid only if the crack remains open for any time. 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 of the modal participation factors α_i resulting from transient computation,
- recovery (in TABL_K_MODA) of the modal factors of intensity of the stresses,
- recombination and printing of the stress intensity factors dynamics.

The number M of modes in the base of recombination corresponds, by default, with the number of modes M^{trans} used in transient computation. If the number M^{tabl} of modes present in array TABL_K_MODA provided in entry is lower than M^{trans}, an alarm message is transmitted and computation continues while taking M equal to M^{tabl}.

5 Example

One treats here the case of a structure 3D subjected to a loading transient dynamics (cf case test sdls114b [V2.03.114]). After construction of the mass matrixes and stiffness, one can calculate the eigen modes of structure:

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

One can then calculate the displacement of 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 = "OUI',
                                    PAS=pas,),
                      EXCIT=_F (VECT_ASSE=CHA_ASS,
                                FONC_MULT=RAMPE,),
                      ARCHIVAGE=_F (PAS_ARCH = nbpas,),
                      PRINTING = _F (TOUT=' OUI',),);
```

The computation in fracture mechanics starts with the definition of the crack tip:

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

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

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