Operator CALC_MISS

1 Goal

The object of this order is to prepare the data, to carry out the Miss3D software, then post-to treat the results of this one to produce exploitable concepts in *Code_Aster*.

According to the arguments as starter of the order, one obtains the harmonic, temporal answer of the structure, or the evolutions of displacements, speeds, accelerations in certain places. Or even of the concepts of load of nodal seismic force transitory.

This operator can also be used jointly with DYNA_NON_LINE for non-linear transitory calculations, by the method Laplace-time (*cf.* CAS-test MISS03 and its associated documentation [V1.10.122]).

Advices of implementation of calculations of interaction ground-structure are provided in [U2.06.07] and [U2.06.05].

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Contents

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2 Syntax

```
resu = CALC_MISS (

      ♦  TYPE_RESU    =  / 'FILE',
                         / 'HARM_GENE',
                         / 'TRAN_GENE',
                         / 'TABLE',
                         / 'TABLE_CONTROL',
                         / 'FICHIER_TEMPS',

      ◊  PROJECT         =  project   ,                  [KN]
      ◊  REPERTOIRE   =  repertoire,               [KN]
      ◊  VERSION      =     / 'V6.6',              [DEFECT]
                            / 'V6.5',
      ♦  / TABLE_SOL     =  tabsol,                [table]
         / MATER_SOL = _F (  ♦ E = Young,          [R]
                             ♦ NAKED = naked,          [R]
                             ♦ RHO = rho,          [R]
                         ),
       # if ISSF=' OUI' under PARAMETER
       ◊  MATER_FLUIDE = _F (    ♦ RHO = rho,          [R]
                             ♦ THAT = that ,       [R]
                             ♦ AMOR_BETA = beta ,      [R]
                             ♦ DEMI_ESPACE =  / 'YES' , [ DEFECT ]
                                              / 'NOT',
                         ),

   General data
   / If TYPE_RESU = 'FILE' or 'TABLE_CONTROL':

      ♦  / MACR_ELEM_DYNA = mael,                  [macr_elem_dyna]
         / BASE_MODALE    = basmo,                 [mode_meca]
             ◊  MATR_RIGI = matrig,                [matr_asse_depl_*]
             ◊  MATR_MASS = matmas,                [matr_asse_depl_r]
      ◊  AMOR_REDUIT      = l_amor,                [l_R]
      ♦  GROUP_MA_INTERF  = grma,                  [grma]
      ◊  GROUP_MA_FLU_STR = gr_flustr,             [l_group_ma]
      ◊  GROUP_MA_FLU_SOL = gr_flusol,             [l_group_ma]
      ◊  GROUP_MA_SOL_SOL = gr_solsol,             [l_group_ma]

      ◊  UNITE_IMPR_ASTER =  / uimpast,            [I]
      ◊  UNITE_RESU_IMPE  =  / uresimp,            [I]
      ◊  UNITE_RESU_FORC  =  / uresfor,            [I]

      ◊ / SOURCE_SOL =_F ( ♦ DIRECTION  = (d1, d2, d3),  [l_R]
                           ♦ NOT     = (d1, d2, d3),  [l_R]
                          ),
        / SOURCE_FLUIDE =_F ( ♦ NOT  = (d1, d2, d3))  [l_R]


   / If TYPE_RESU = 'HARM_GENE', 'TRAN_GENE', or 'COUNTS':

      ◊  MACR_ELEM_DYNA   = mael,                  [macr_elem_dyna]
      ♦  BASE_MODALE      = basmo,                 [mode_meca]
      ♦  MATR_RIGI        = matrig,                [matr_asse_depl_*]
      ♦  MATR_MASS        = matmas,                [matr_asse_depl_r]
      ♦  /   AMOR_REDUIT  = l_amor,                [l_R]
```

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```
            / MATR_AMOR     = matamo,                   [matr_asse_depl_r]
        ♦  GROUP_MA_INTERF  = grma,                     [grma]
        ◊  GROUP_MA_FLU_STR = gr_flustr,                [l_group_ma]
        ◊  GROUP_MA_FLU_SOL = gr_flusol,                [l_group_ma]
        ◊  GROUP_MA_SOL_SOL = gr_solsol,                [l_group_ma]

        ◊  UNITE_IMPR_ASTER =  uimpast,                 [I]
        ◊  UNITE_RESU_IMPE  =  uresimp,                 [I]
        ◊  UNITE_RESU_FORC  =  uresfor,                 [I]

    / If TYPE_RESU = 'FICHIER_TEMPS':

        ♦  / MACR_ELEM_DYNA = mael,                     [macr_elem_dyna]
           / BASE_MODALE    = basmo,                    [mode_meca]
               ◊  MATR_RIGI = matrig,                   [matr_asse_depl_*]
               ◊  MATR_MASS = matmas,                   [matr_asse_depl_r]
        ◊  AMOR_REDUIT      = l_amor,                   [l_R]
        ♦  GROUP_MA_INTERF  = grma,                     [grma]

        ◊  UNITE_IMPR_ASTER =  / uimpast,               [I]
                               / 25,                    [DEFECT]
        ◊  UNITE_RESU_RIGI  =  / uresrig,               [I]
        ◊  UNITE_RESU_AMOR  =  / uresamo,               [I]
        ◊  UNITE_RESU_MASS  =  / uresmas,               [I]

        ◊  INST_FIN         =  tfin,                    [R]
        ◊  PAS_INST         =  not,                     [R]
        ◊  FACTEUR_INTERPOL =  / finterp,               [I]
                               / 1,                     [DEFECT]
        ◊  PCENT_FREQ_CALCUL =/pcentfc,             [R]
                               / 0. ,                   [DEFECT]
        ◊  PRECISION        =  / precis,                [R]
                               / 1.E-6,                 [DEFECT]
        ◊  COEF_SURECH      =  / coefsur,               [R]
                               / 1.35,                  [DEFECT]
        ◊  MATR_GENE = _F (
               ◊  DECOMP_IMPE     =  /  'PRODUCED',      [DEFECT]
                                     /  'SANS_PRODUIT',
               ♦  AMOR_HYST       =  /  'DANS_IMPEDANCE',
                                     /  'DANS_MATR_AMOR',
               ◊  MATR_MASS = matma,  [matr_asse_gene_r,matr_asse_depl_r]
               ◊  MATR_RIGI = matri,  [matr_asse_gene_*,matr_asse_depl_r]
           / If AMOR_HYST = 'DANS_MATR_AMOR' :
               ♦  MATR_AMOR = matam,  [matr_asse_gene_*,matr_asse_depl_r]
           / If AMOR_HYST = 'DANS_IMPEDANCE' :
               ◊  MATR_AMOR = matam,  [matr_asse_gene_*,matr_asse_depl_r]
                               ),
        ◊  EXCIT_SOL = _F (
               ♦  UNITE_RESU_FORC  =  / uresfor,             [I]
               ◊  NOM_CHAM         =  / 'DEPL'               [DEFECT]
                                      / 'QUICKLY'
                                      / 'ACCE'
               ◊  CHAM_X              =  fctchx          [function]
               ◊  CHAM_Y              =  fctchx          [function]
               ◊  CHAM_Z              =  fctchx          [function]
                               ),
        ◊  TYPE_FICHIER_TEMPS   = / 'ASCII',             [DEFECT]
                                  / 'BINARY',
```

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```
Parameters of Miss3D calculation:

        ♦  PARAMETER = _F (
           ♦   /   ♦ FREQ_MIN    =   fmin,               [R]
                   ♦ FREQ_MAX    =   fmax,               [R]
                   ♦ FREQ_PAS    =   fpas,               [R]
               /   ♦ LIST_FREQ   =   lfrli,              [l_R]
               /   ♦ FREQ_IMAG   =   fimag,              [R]
           ◊   Z0             =   / 0. ,                 [DEFECT]
                                  / z0,                  [R]
           ◊   TYPE           =   / 'BINARY',
                                   / 'ASCII'                [DEFECT]
           ◊   ISSF           =   /'NOT'                 [DEFECT]
                                  /'YES'
           ◊   ALUMINUM           =  / 0.                   [DEFECT]
                                  / aluminum,               [R]
            ◊   SURFING           =  / 'NOT',               [DEFECT]
                                  / 'YES',
           ◊   DREF           =   dref,                  [R]
           ◊   CAR       =   / 'NOT',                [DEFECT]
                                  / 'YES',
           ◊   ♦  OFFSET_MAX    =   offmax,              [R]
               ♦  OFFSET_NB     =   offnb,               [I]
  / If CAR = ' NOT ':
           ◊   RFIC           =   / 0. ,                 [DEFECT]
                                  / rfic,                [R]
           ◊   Algorithm          =  / 'REGU'
                                  / 'DEPL'
           ◊   ♦ SPEC_MAX        =  spemax,              [R]
               ♦ SPEC_NB         =  spenb,               [I]

  / If CAR = 'YES':

           ◊   OPTION_DREF       =  / 'NOT',             [DEFECT]
                                     / 'YES',
           ◊   OPTION_RFIC       =  / 'NOT',             [DEFECT]
                                     / 'YES',
            ◊   RFIC             =  rfic,                 [R]
           ◊   SPEC_MAX          =  spemax,              [R]
           ◊   SPEC_NB           =  / 16384               [DEFECT]
                                     / spenb,            [I]
           ◊   COEF_OFFSET       =  / 12,                [DEFECT]
                                     / coffset,          [I]
           ),

     Parameters of postprocessing
     / If TYPE_RESU = 'TRAN_GENE':

        ♦  MODEL             =   Mo,                     [model]
        ♦  /   |  ACCE_X     =   acce_x,                 [function]
               |  ACCE_Y     =   acce_y,                 [function]
               |  ACCE_Z     =   acce_z,                 [function]
           /   |  DEPL_X     =   depl_x,                 [function]
               |  DEPL_Y     =   depl_y,                 [function]
               |  DEPL_Z     =   depl_z,                 [function]
        ◊  INST_FIN          =   l_tfin,                 [l_R]
        ◊  PAS_INST          =   l_pas,                  [l_R]
```

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```
/ If TYPE_RESU = 'HARM_GENE':

    ♦  MODEL            =  Mo,                     [model]
     ♦  /  ♦ /  |  ACCE_X =  acce_x,               [function]
                |  ACCE_Y =  acce_y,               [function]
                |  ACCE_Z =  acce_z,               [function]
             /  |  DEPL_X =  depl_x,               [function]
                |  DEPL_Y =  depl_y,               [function]
                |  DEPL _Z   =  depl_z,               [function]
        ◊  INST_FIN  =  l_tfin,                    [l_R]
        ◊  PAS_INST  =  l_pas,                     [l_R]
      /  EXCIT_HARMO  =  _F (
           identical to keyword EXCIT of DYNA_LINE_HARM
              (cf. [U4.53.11]) except for type
              waited for VECT_ASSE:
           ◊  VECT_ASSE = chamno,                  [cham_no]
        ),

/ If TYPE_RESU = 'TABLE':

    ♦  MODEL            =  Mo,                     [model]
    ♦  GROUP_NO         =  grno,                   [l_grno]
    ♦  |  ACCE_X        =  acce_x,                 [function]
       |  ACCE_Y        =  acce_y,                 [function]
       |  ACCE_Z        =  acce_z,                 [function]
    ◊  INST_FIN         =  tfin,                   [R]
    ◊  PAS_INST         =  not,                    [R]
    ♦  NORMALIZES                 =  norm,                [R]
    ♦  AMOR_SPEC_OSCI      =  l_amor,              [l_R]
    ◊  LIST_FREQ_SPEC_OSCI =  l_freq,              [l_R]

/ If TYPE_RESU = 'TABLE_CONTROL':

    ♦  GROUP_MA_CONTROL =  grma,                   [grma]
    ◊  /  |  ACCE_X        =  acce_x,              [function]
          |  ACCE_Y        =  acce_y,              [function]
          |  ACCE_Z        =  acce_z,              [function]
       ◊  INST_FIN         =  tfin,                [R]
       ◊  PAS_INST         =  not,                 [R]
       ♦  NORMALIZES                 =  norm,             [R]
       ♦  AMOR_SPEC_OSCI      =  l_amor,           [l_R]
       ◊  LIST_FREQ_SPEC_OSCI =  l_freq,           [l_R]

/ If TYPE_RESU = 'LOAD':

     ♦ MODEL            =  Mo,                     [model]
     ♦ GROUP_NO_AFFE    =  GNo,                    [l_no]
    ♦  FONC_SIGNAL      =  depl,                   [function]
    ♦  NOM_CMP          =  /'DX'
                           /'DY'
                           /'DZ'
    ◊  UNITE_RESU_FORC  =  /  uresfor,             [I]
                           /  25,                  [DEFECT]
    ◊  FREQ_MAX  =  fmax,                          [R]
    ◊  VARI             =  /'NOT'                  [DEFECT]
                           /'YES'
  /  If VARI=' NON' identical to the keywords of DYNA_ISS_VARI:
```

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```
        ◊  PRECISION        =  /  prec,                [R8]
                               /  0,999,               [DEFECT]

        ♦  INTERF           =  _F  (
                 ♦  GROUP_NO_INTERF  =  ma_interf,     [grma]
                 ♦  MODE_INTERF      =  /  'ALL',
                                        /  'CORPS_RIGI'
                                  ),

        ◊  ISSF             =  /'NOT'                  [DEFECT]
                               /'YES'

        ♦  MATR_COHE        =  _F  (
                 ◊  TYPE       =      / 'MITA_LUCO'
                                      / 'ABRAHAMSON'
                 ◊  VITE_ONDE     =  vite_onde,        [R8]
                                      /  600.0,        [DEFECT]
                 ◊  PARA_ALPHA    =  /  alpha,         [R8]
                                      /  0.5,          [DEFECT]
                                  ),

        ♦  MATR_GENE        =  _F  (
                 ♦  NUME_DDL_GENE=  nugen,             [nume_ddl_gene]
                 ♦  BASE          =  base,             [mode_meca]
                                  ),

        ◊  UNITE_RESU_IMPE  =  /  uresimp,             [I]
                               /  28,                  [DEFECT]

        ◊  TYPE             =  /  'BINARY',
                               /  'ASCII'              [DEFECT]


    Others
        ◊  INFORMATION  =  /  1,                               [DEFECT]
                 /  2,                                 [I]
    )
```

If `TYPE_RESU=' FICHIER'` or `'FICHIER_TEMPS'`, `CALC_MISS` does not produce concept result (one generates only files).
If `TYPE_RESU=' HARM_GENE'`, `resu` is of type `harm_gene`.
If `TYPE_RESU=' TRAN_GENE'`, `resu` is of type `tran_gene`.
If `TYPE_RESU=' TABLE' or 'TABLE_CONTROL'`, `resu` is of type `table`.
If `TYPE_RESU=' CHARGE'`, `resu` is of type `char_meca`.

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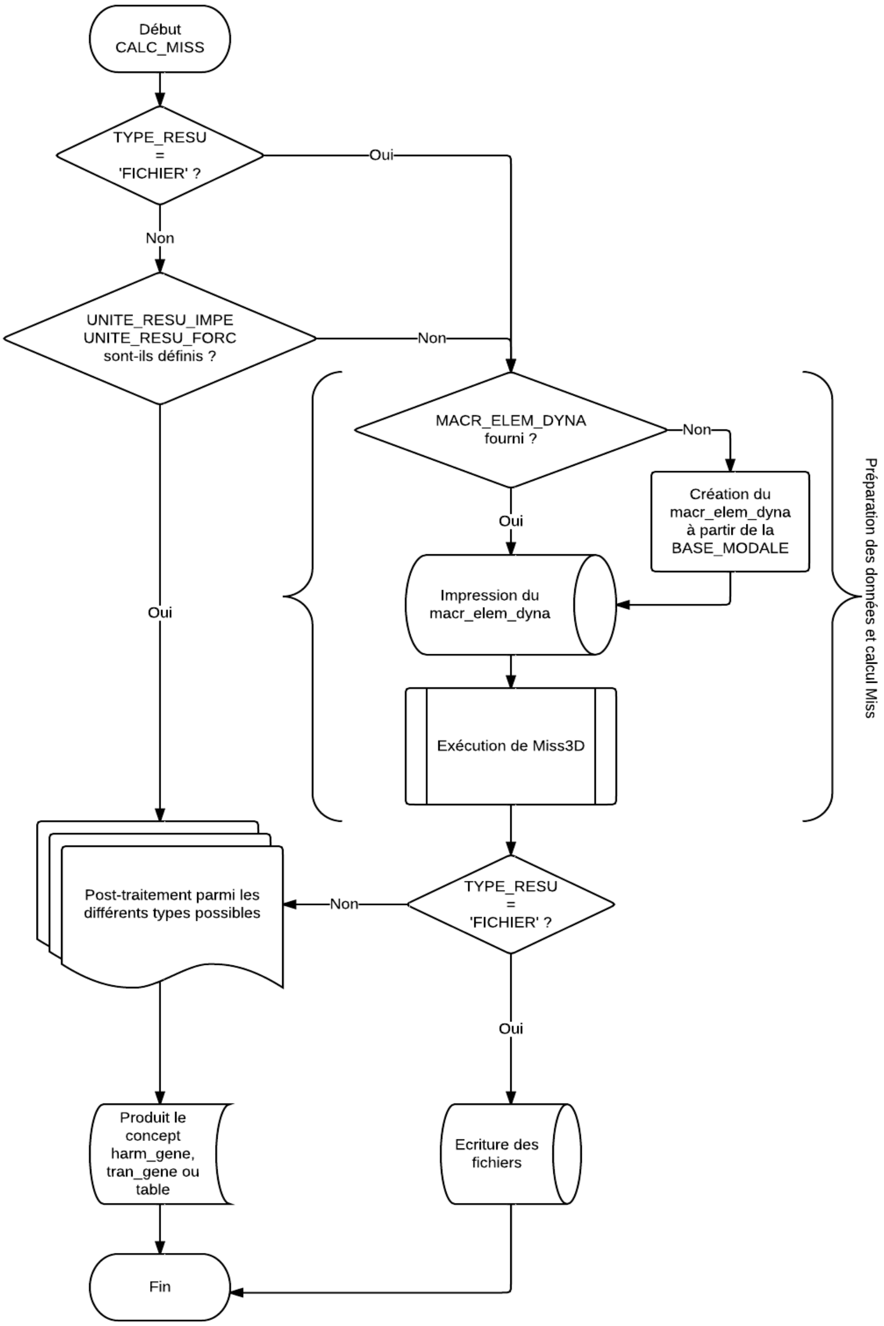
3 Principle of operation

According to its arguments of entry, `CALC_MISS` product a concept whose type varies or does not produce a concept.

- If `TYPE_RESU` is worth '`FILE`'or'`FICHIER_TEMPS`', no concept is produced. Only the execution of Miss3D is launched. The results (impedance of ground and forces seismic) are then written in the files located by the logical units such as `UNITE_RESU_IMPE`, `UNITE_RESU_FORC`, `UNITE_RESU_MASS`, `UNITE_RESU_RIGI` or `UNITE_RESU_AMOR`. There is no postprocessing of the results resulting from Miss3D.
- If `TYPE_RESU = 'LOAD'`, a mechanical load is produced in the form of nodal force.
- If `TYPE_RESU = 'TABLE_CONTROL'`, Miss3D calculation is the same one as for `FILE`. A table is produced containing a specific postprocessing of the results of Miss3D.
- In the contrary case (`TYPE_RESU` is worth '`HARM_GENE`','`TRAN_GENE`'or'`TABLE`'), one carries out Miss3D only if the logical units `UNITE_RESU_IMPE`, `UNITE_RESU_FORC` are not well informed. If not, the provided files are used. Postprocessing is then carried out and the required concept turned over to the user.



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During the execution of Miss3D, if the keyword MACR_ELEM_DYNA is informed, one uses it. If not, it is created by CALC_MISS starting from the operands BASE_MODALE, MATR_RIGI and MATR_MASS.

Notice

In the case FICHIER_TEMPS, one makes a call in Miss3D for each frequency of calculation. These calls can be made in parallel. For that, it is enough to carry out parallel version MPI of Code_Aster and to ask several processors (not additional keyword necessary).

4 Definition of the model

4.1 Keyword TYPE_RESU

Defines the type of analysis to carry out. Five values are allowed:

- FILE : only the execution of Miss3D is carried out. One directly recovers the files produced by Miss3D in the files located by the logical units UNITE_RESU_IMPE and UNITE_RESU_FORC. CALC_MISS do not turn over a concept (nothing on the left the sign "=").
- FICHIER_TEMPS : only the execution of Miss3D is carried out. One directly recovers the files produced by Miss3D in the files located by the logical units UNITE_RESU_RIGI, UNITE_RESU_MASS, UNITE_RESU_AMOR and UNITE_RESU_FORC. CALC_MISS do not turn over a concept (nothing on the left the sign "="). That corresponds to the method Laplace-time.
- LOAD : one calculates a mechanical load starting from the file of the seismic forces.
- HARM_GENE : one calculates the harmonic answer of the structure (of type harm_gene) after having carried out Miss3D or starting from the files resulting from a preceding resolution.
- TRAN_GENE : one calculates the temporal answer of the structure (of type tran_gene) after having carried out Miss3D or starting from the files resulting from a preceding resolution.
- TABLE : one calculates the harmonic response of the structure to a unit request in certain points, and one turns over a concept of the type table who contains the functions answers in displacement, speed, acceleration and spectrum of oscillator recombined on the cases of loading.
- TABLE_CONTROL : one recovers Miss3D calculation the transfer functions transfer in certain check-points and the answers harmonic and temporal to a provided acceleration. One produces a concept of the type table.

4.2 Operands PROJET/REPERTOIRE

The keyword REPERTOIRE allows to define a repertoire (entered by its complete way on the object computer) where will be carried out Miss3D calculation. One will be able to find there all and result the data files of Miss3D (for debugging for example). These files will start with a name-radical given by the operand PROJECT (which is worth MODEL by default).
If REPERTOIRE is not defined, the execution will take place in a temporary repertoire which will be destroyed at the end of the calculation.

4.3 Operand VERSION

Name of the version of Miss3D. The value by default corresponds to the version of Miss3D in exploitation.

4.4 Operand MACR_ELEM_DYNA

It is the dynamic macronutrient of the structure (standard macr_elem_dyna) product by the ordering of the same name (*cf.* [U4.65.01]). If this one is not indicated, it will be calculated automatically by CALC_MISS starting from the modal base and provided matrices.

4.5 Operand BASE_MODALE

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Base modes of the structure. If MACR_ELEM_DYNA is not well informed, this modal base is used to determine it.
When one carries out only Miss3D calculation (TYPE_RESU=' FICHIER'), one provides is MACR_ELEM_DYNA, that is to say BASE_MODALE.
When for postprocessing is asked, it is necessary to inform the keyword BASE_MODALE (used for harmonic calculation). One can despite everything provide a specific macronutrient where necessary.

4.6 Operands MATR_RIGI and MATR_MASS

These keywords make it possible to provide the matrices of rigidity and mass of the structure.
They will be used during harmonic calculation and, if necessary, to create the dynamic macronutrient.

4.7 Operand MATR_AMOR

This keyword makes it possible to provide a matrix of damping of the structure used during harmonic calculation in alternation with the use of modal damping with the keyword AMOR_REDUIT.

4.8 Operand UNITE_IMPR_ASTER

Logical number of unit on which one can recover the file produced by the operator IMPR_MACR_ELEM format 'MISS_3D' called in-house by CALC_MISS. The value by default is 25.

4.9 Operands UNITE_RESU_IMPE, UNITE_RESU_RIGI, UNITE_RESU_MASS, UNITE_RESU_AMOR, UNITE_RESU_FORC

Numbers of logical unit of the files containing the impedances of ground (or its decomposition in rigidity, mass and damping) and the forces seismic by frequency.
If one asks only for Miss3D calculation, UNITE_RESU_IMPE, UNITE_RESU_RIGI, UNITE_RESU_MASS, UNITE_RESU_AMOR and UNITE_RESU_FORC are used according to the cases to store the files results.
If for a postprocessing is asked, one should use these arguments only if Miss3D calculation were carried out before (the files are then data for CALC_MISS).
Operands UNITE_RESU_RIGI, UNITE_RESU_MASS, UNITE_RESU_AMOR are of a use specific to the method Laplace-time (case TYPE_RESU = 'FICHIER_TEMPS') and the presence of UNITE_RESU_AMOR or of UNITE_RESU_MASS compulsory the keyword factor makes MATR_GENE.

Note: In the Miss3D execution, the postprocessing of the impedances (respectively of the seismic forces) is carried out only if the keyword UNITE_RESU_IMPE (respectively UNITE_RESU_FORC) is well informed. This makes it possible to reduce the computing time a little bit.

4.10 Operand GROUP_MA_INTERF

This keyword makes it possible to define the list of the surface groups of meshs constituting the interface ground-structure (transmitted in-house to the operator IMPR_MACR_ELEM [U7.04.33]).

4.11 Operands GROUP_MA_FLU_STR/GROUP_MA_FLU_SOL/GROUP_MA_SOL_SOL

In the case of an interaction ground-fluid-structure, these keywords make it possible to supplement the list of the groups of surface meshs respectively made up of the interfaces fluid structure, fluid-ground and free ground (transmitted in-house to the operator IMPR_MACR_ELEM [U7.04.33]).

4.12 Operand TABLE_SOL

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The data of description of the stratifications of ground are provided in the form of a table produced by the order DEFI_SOL_MISS (*cf.* [U7.02.34]).

4.13 Operand MATER_SOL

For a homogeneous ground, one provides the properties of the ground: E is the Young modulus, NAKED the Poisson's ratio, RHO density.

4.14 Operand MATER_FLUIDE

In the case of an analysis of interaction ground-fluid-structure (ISSF=' OUI' under PARAMETER), the properties of the fluid are provided: RHO is the density, THAT the celerity of the waves, AMOR_BETA damping.
It is also indicated if the field represents a fluid half space or not according to the definition of Miss3D.

4.15 Operand SOURCE_SOL

Keyword factor defining the loads resulting from point sources in the ground field, given by their direction and the coordinates of the source. Only if TYPE_RESU=' FICHIER'.
The vector DIRECTION is automatically normalized to 1 by Miss3D.

4.16 Operand SOURCE_FLUIDE

Keyword factor defining the loads resulting from point sources of pressure in the fluid field, given by the coordinates of the source. Only if TYPE_RESU=' FICHIER'.

4.17 Operand AMOR_REDUIT

List of reduced depreciation (transmitted in-house to DYNA_LINE_HARM [U4.53.11]).
That is to say $nbmode$ the number of dynamic modes defined in the modal base, and $nbamor$ the number of provided reduced depreciation.
If $nbamor < nbmode$, then one supplements the list of depreciation until $nbmode$ with the last damping of the list.
One adds then a null damping which will be applied to the static modes present.

4.18 Operand PRECISION

Parameter of precision of the method of calculating Laplace-time (case TYPE_RESU = 'FICHIER_TEMPS'). One strongly advises to leave the value by default.

4.19 Operand COEF_SURECH

Parameter to impose the coefficient of oversampling for the method Laplace-time. One recommends to keep the value by default in order to guarantee a good performance on all the window of calculation. Indeed, when this operand is worth 1.0 (not oversampling), the transitory impedance is valid only on 70 % approximately of the window of calculation. Thus, if the user increases this coefficient, the precision of calculation will be improved, but with a overcost of calculation proportional to this value.

4.20 Operand FACTEUR_INTERPOL

Parameter of the method of calculating Laplace-time (case TYPE_RESU = 'FICHIER_TEMPS'). It gives of interpolation and thus the factor step value of reduction of the computing time.

4.21 Operand PCENT_FREQ_CALCUL

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Parameter of the method of calculating Laplace-time. It expressed as a percentage gives the ratio between the number of samples without interpolating and the full number of samples.

4.22 Operand TYPE_FICHIER_TEMPS

Parameter of the method of calculating Laplace-time (case TYPE_RESU = 'FICHIER_TEMPS') who allows to specify the format of the temporal file of exit, enters 'ASCII' (defect) and 'BINARY'. The binary format makes it possible to gain place and a little time but is not readable by the user. The format thus defined must be coherent with the format specified with the keyword TYPE under the option FORCE_SOL ofAFFE_CHAR_MECA.

4.23 Operand MATR_GENE

This keyword optional factor is used for the method Laplace-time, therefore for TYPE_RESU = 'FICHIER_TEMPS'. It makes it possible to specify all the options relating to calculations of impedance ((*cf.* CAS-test MISS03 and its associated documentation [V1.10.122]). If this keyword optional factor is used, then it is also necessary to define the values of the operands UNITE_RESU_AMOR and UNITE_RESU_MASS.

4.23.1 Operand DECOMP_IMPE

This keyword makes it possible to specify the method of decomposition of the impedance. One recommends to leave the value by default ('PRODUCED').

4.23.2 Operand AMOR_HYST

This keyword makes it possible to specify the way in which will be taken into account damping hysteretic in the ground.
This keyword makes it possible to specify the method of decomposition of the impedance. One recommends to leave the value by default ('PRODUCED'). There are two possible choices:

- 'DANS_MATR_AMOR' : the matrix of damping given by the user (via MATR_AMOR under MATR_GENE) depreciation account hysteretic of the ground holds.
- 'DANS_IMPEDANCE' : it is the contrary case of the precedent.

4.23.3 Operands MATR_MASS, MATR_RIGI and MATR_AMOR

These arguments are used to define the matrices of mass, stiffness and damping which can be used by the decomposition of the impedance.
If one has AMOR_HYST = 'DANS_MATR_AMOR', then it is obligatorily necessary to inform, at least, MATR_AMOR.
Contrary, AMOR_HYST = 'DANS_IMPEDANCE' , then it is enough, at least, to give one of the three matrices for the decomposition.

This keyword makes it possible to specify the way in which will be taken into account damping hysteretic in the ground.
This keyword makes it possible to specify the method of decomposition of the impedance. One recommends to leave the value by default ('PRODUCED'). There are two possible choices:

- 'DANS_MATR_AMOR' : the matrix of damping given by the user (via MATR_AMOR under MATR_GENE) depreciation account hysteretic of the ground holds.
- 'DANS_IMPEDANCE' : it is the contrary case of the precedent.

4.24 Operand EXCIT_SOL

This keyword optional factor is used to characterize the excitation transmitted by the ground: definition of the seismic forces. If one wants to calculate only impedances, this keyword is useless.

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4.24.1 Operand **UNITE_RESU_FORC**

Allows to define the logical unit of the generated file which will contain the seismic forces, which will be reusable in DYNA_NON_LINE via a loading of the type EXCIT_SOL in AFFE_CHAR_MECA (*cf.* CAS-test MISS03C and its documentation associated [V1.10.122]).

4.24.2 Operands **NOM_CHAM**, **CHAM_X**, **CHAM_Y** and **CHAM_Z**

These arguments are used to specify the entry signal. Its nature (signal in displacement, speed or acceleration) is indicated by the value of NOM_CHAM. By default one expects an imposed displacement.
This signal can have from one to three components, following X, Y and Z and for each direction, one can give the corresponding function: CHAM_X, CHAM_Y and CHAM_Z.

5 Miss3D calculation – keyword factor **PARAMETER**

This keyword factor makes it possible to enter the parameters of Miss3D calculation: type of interface, of foundation, frequencies of calculation, discretization spectral and space which supplement the data of description of the ground.

These data are necessary as soon as one must carry out Miss3D.

Even if CALC_MISS is used in two times (calculation then postprocessing), the keyword factor PARAMETER is always necessary because the beach of frequency of Miss3D calculation can be used during postprocessing. A good practice consists in not modifying the keyword PARAMETER between these two stages.

Mode AUTO=' OUI' allows automatically to define the value of certain parameters, in accordance with the advices of documentations [U2.06.07] and [U2.06.05]. That relates to the parameters OFFSET_MAX, OFFSET_NB, Algorithm, DREF, RFIC and SPEC_MAX.

5.1.1 Operands **FREQ_MIN, FREQ_MAX, FREQ_PAS**

These operands provide the terminals and the step of frequency of Miss3D calculation of frequential resolution (thus all the cases except when TYPE_RESU=' FICHIER_TEMPS').

5.1.2 Operand **LIST_FREQ**

This operand provides the list of the real frequencies of Miss3D calculation. This data is excluded with the keywords FREQ_xxx.
The use of LIST_FREQ is not possible that if one does the Miss3D calculation alone or if one seeks the answer to a harmonic excitation (TYPE_RESU=' HARM_GENE' and presence ofEXCIT_HARMO).
In the other cases, it is necessary to provide a list of frequencies to constant step by using the keywords FREQ_MIN, FREQ_MAX, FREQ_PAS.

5.1.3 Operand **FREQ_IMAG**

This operand is to be used only in mode TYPE_RESU=' FICHIER_TEMPS' (what corresponds to the method Laplace-time). Indeed this keyword is used to define the imaginary part of the complex frequency when one places oneself in the field of Laplace. In all the other types of calculation, one is in the frequential field and the frequency is then always purely real. One can use one keyword at the same time among FREQ_IMAG, FREQ_MIN and LIST_FREQ.

5.1.4 Operand **Z0**

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This operand gives the dimension of the free surface of the ground.

5.1.5 Operand SURFING

This operand indicates if one has or not a shallow foundation.

5.1.6 Operand ISSF

This operand indicates if one has or not a field of fluid and thus also of the interfaces fluid-structure, ground-fluid and free ground indicated by the operands GROUP_MA_FLU_STR GROUP_MA_FLU_SOL and GROUP_MA_SOL_SOL in the order.

5.1.7 Operand RFIC

This operand indicates the value of the homogeneous parameter to a characteristic distance necessary to eliminate fictitious resonances.

5.1.8 Operand Algorithm

This operand indicates for the calculation of the impedances if one uses the algorithm of regularization for nonsurface foundations or another algorithm for shallow foundations.

5.1.9 Operand DREF

This operand indicates the value of the homogeneous parameter to a characteristic distance which makes it possible to eliminate the vertical slope from the impedance for a worthless frequency.

5.1.10 Operand ALUMINUM

This operand indicates the value of the absorption coefficient ranging between 0 and 1 to the interface ground-fluid. Valid if ISSF=' OUI' .

5.1.11 Operands OFFSET_MAX, OFFSET_NB

These operands provide the maximum terminal and the space discretization division for the calculation of the impedances by Miss3D starting from the data of ground.

5.1.12 Operands SPEC_MAX, SPEC_NB

These operands provide the maximum terminal and the spectral discretization division for the calculation of the impedances by Miss3D starting from the data of ground.
If they are not indicated, a spectral discretization will be calculated automatically by Miss3D.
In automatic mode (AUTO=' OUI'), in the case of a homogeneous ground, one can calculate the value to be given to SPEC_MAX, according to the formula given in documentation [U2.06.07].

5.1.13 Operand TYPE

This operand makes it possible to store the impedances frequential calculated in a binary file of format. If one wants to exploit them by the order LIRE_IMPE_MISS [U7.02.32], it will then be necessary to take care to use the same type of file.

5.1.14 Operand CAR

This operand allows to start the mode automatiqu E of definition of the value of certain parameters of Miss3d , in accordance with the advices of documentations [U2.06.07] and [U2.06.05] . That relates to the parameters OFFSET_MAX , OFFSET_NB , Algorithm , DREF , RFIC and SPEC_MAX . These automatic values are displayed in the file of message.

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It should be noted that so with this automatic mode, the user nevertheless gives the value of whole or part of these parameters, these values come to overload the computed values automatically.

5.1.15 Operand OPTION_DREF

This operand allows to specify, with the mode AUTO=' OUI' if one must use the option DREF . If so, then the code calculates the value automatically to be given to him.

5.1.16 Operand OPTION_RFIC

This operand allows to specify, with the mode AUTO=' OUI' if one must use the option RFIC . If so, then the code calculates the value automatically to be given to him.

5.1.17 Operand COEF_OFFSET

This operand allows to define the coefficient of oversampling for the automatic calculation of the parameter OFFSET_NB (*cf.* documentations [U2.06.05] and [U2.06.07]). By default it is worth the value recommended of 12 (12 points per element).

6 Postprocessing

If TYPE_RESU is different from 'FILE', the files results of Miss3D are post-treaties by CALC_MISS in order to provide the harmonic or temporal response of the structure, or the evolutions of the sizes characteristic (displacement, speed, acceleration, spectrum of oscillator) in certain points of postprocessing.

6.1 Common parameters

6.1.1 Operands ACCE_X, ACCE_Y, ACCE_Z and PAS_INST/INST_FIN

Operands ACCE_X , ACCE_Y and ACCE_Z allow to provide accélérogrammes. Those can be on a temporal basis or a frequential basis.

When accélérogrammes on temporal basis are provided, the keywords PAS_INST and INST_FIN are obligatory and the accélérogrammes then are systematically interpolated on the interval [0. , INST_FIN] with the step PAS_INST.

When accélérogrammes on frequential basis are provided, that has for effect to pass the stages of interpolation and FFT. Lbe keywords PAS_INST and INST_FIN do not have to be well informed.

6.2 Calculation of the harmonic or temporal answer of the structure

One is in the case TYPE_RESU = 'HARM_GENE' (harmonic answer) or 'TRAN_GENE' (temporal answer).
One then calculates the harmonic response of the structure to the loading provided (accélérogrammes or EXCIT_HARMO).
In the case 'TRAN_GENE', one carries out the temporal restitution by using the operator REST_SPEC_TEMP (option PROL_ZERO).
The frequencies used for harmonic calculation depend on the loading and are described in the paragraph 6.2.2.

6.2.1 Operand MODEL

It is the model of the structure (transmitted to DYNA_LINE_HARM).

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6.2.2 Operands `ACCE_X`, `ACCE_Y`, `ACCE_Z`, `DEPL_X`, `DEPL_Y`, `DEPL_Z`, `EXCIT_HARMO`

One provides is `EXCIT_HARMO`, that is to say a accélérogramme in one or more directions (`ACCE_X`, `ACCE_Y`, `ACCE_Z`), that is to say the displacements imposed in one or more directions (`DEPL_X`, `DEPL_Y`, `DEPL_Z`).

In the presence of `EXCIT_HARMO`, the beach of frequencies used for harmonic calculation is the same one as that used for Miss3D calculation: [`FREQ_MIN`, `FREQ_MAX`] by step of `FREQ_PAS` Hz or `LIST_FREQ`.

The imposed accélérogrammes or displacements can be given either in frequential base, or in temporal base. In this last case, these functions are interpolatedES while using `PAS_INST`, noted dt and `INST_FIN`, noted t_{max} , then one FFT their is applied. Lbeach of frequencies used has is that of FFT accélérogramme, is:

$\left[0,\frac{1}{2\,dt}\right]$ with a step of $df=\frac{1}{npas\times dt}$ where $npas=2^n$, tq $npas\geq\frac{t_{max}}{dt}$.

In frequential base, one should not inform keywords `PAS_INST` and `INST_FIN`, in temporal base they must obligatorily be indicated.

6.3 Calculation of the evolutions in certain points

One is thus in the case `TYPE_RESU=' TABLE'`.
In this case, one calculates the harmonic response of the structure to a unit acceleration (in the directions requested). Then, for each loading, one recombines in each place of postprocessing M unit frequential contributions:

$$u_M(f)=u_x.FFT(acce_x)+u_y.FFT(acce_y)+u_z.FFT(acce_z)$$

One also calculates FFT of this answer and the spectrum of oscillator provided by `CALC_FONCTION`/`SPEC_OSCI`.
One makes in the same way for $\dot{u}_M$ and $\ddot{u}_M$.

All these functions are stored in the produced table:

GROUP_NO	NOM_CHAM	NOM_PARA	FONC_X	FONC_Y	FONC_Z
	ACCE	INST	ACCE1	ACCE2	ACCE3
	ACCE	FREQ	_9003066	_9003068	_9003070
TOP	DEPL	INST	_9003129	_9003135	_9003141
TOP	DEPL	FREQ	_9003128	_9003134	_9003140
TOP	DEPL	SPEC_OSCI	_9003130	_9003136	_9003142
TOP	QUICKLY	INST	_9003147	_9003153	_9003159
TOP	QUICKLY	FREQ	_9003146	_9003152	_9003158
TOP	QUICKLY	SPEC_OSCI	_9003148	_9003154	_9003160
TOP	ACCE	INST	_9003165	_9003171	_9003177
TOP	ACCE	FREQ	_9003164	_9003170	_9003176
TOP	ACCE	SPEC_OSCI	_9003166	_9003172	_9003178

One finds thus for each case of loading (for the first `NUME_CAS = 0`):

- On the first line, the “functions loading”, i.e. accélérogrammes of the excitation (temporal, `NOM_PARA=' INST'`) in the 3 directions: `FONC_X`, `FONC_Y`, `FONC_Z`.
- On the second-row forward, them FFT of these signals (`NOM_PARA=' FREQ'`).
- Then for each point (here `TOP`), evolution of displacement, speed and acceleration. With for each one, the signal, its FFT and the spectrum of oscillator.

6.3.1 Operand `MODEL`

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It is the model of the structure (transmitted to `DYNA_LINE_HARM`).

6.3.2 Operands ACCE_X, ACCE_Y, ACCE_Z, INST_FIN, PAS_INST

One provides a accélérogramme in one or more directions (`ACCE_X`, `ACCE_Y`, `ACCE_Z`), one final moment (`INST_FIN`) and a step of time (`PAS_INST`).
The beach of frequency of harmonic calculation is given starting from the accélérogrammes as in the paragraph 6.2.2. All the accélérogrammes must have the same step of time and this one must be constant.

6.3.3 Operand NORMALIZES, AMOR_SPEC_OSCI, LIST_FREQ_SPEC_OSCI

These parameters are transmitted to `CALC_FONCTION` for the option `SPEC_OSCI` (*cf.* [U4.32.04]) where `AMOR_REDUIT` was famous in `AMOR_SPEC_OSCI` not to confuse with the list of depreciation used for harmonic calculation. In the same way `LIST_FREQ` was also famous here in `LIST_FREQ_SPEC_OSCI` to avoid confusions with the keyword `LIST_FREQ` who is used to specify the list of frequencies for harmonic calculation and MISS3D (*cf.* paragraph 5.1.2).

6.4 Postprocessing of the results at the check-points

One is thus in the case `TYPE_RESU=' TABLE_CONTROL'`.

6.4.1 Operand GROUP_MA_CONTROL

It is the group of the specific meshs locating the check-points (transmitted to `IMPR_MACR_ELEM`). During postprocessing, functions answers are created for each point which is taken in the order of definition of this group of meshs.
Thus, in the table, the indicated point `PC1` does not correspond in a general way to a node or groups named node `PC1`. It is the first specific mesh `GROUP_MA_CONTROL`.

6.4.2 Operands ACCE_X, ACCE_Y, ACCE_Z, INST_FIN, PAS_INST, STANDARD, AMOR_SPEC_OSCI, LIST_FREQ_SPEC_OSCI

Identical to the paragraphs 6.3.2 and 6.3.3.

6.4.3 Produced table

The loading applied in Miss3D calculation is a unit harmonic acceleration.
The first two lines correspond to accelerations `ACCE_X/Y/Z` provided by the user, interpolated with the step of provided time, and its FFT.
In each check-point, one recovers the transfer function transfer in the three directions to this request. They is the lines with `TRANSFERT/FREQ`.
Then, there is the combination:

$a_{Mx}(f)=ft_x(f).FFT(acce_x)$ and even thing in there and Z according to the loading applied.

One also calculates FFT of this answer and the spectrum of oscillator provided by `CALC_FONCTION/SPEC_OSCI`.
All these functions are stored in the produced table (example with a request only `ACCE_Z`):

```
GROUP_NO. NOM_CHAM. .NOM_PARA… FONC_X… .FONC_Y… FONC_Z
. …. .ACCE…. .INST…. -…… -…. _9000034
. …. .ACCE…. .FREQ…. -…… -…. _9000035
PC1…. .TRANSFERT. FREQ…. _9000036. _9000037. _9000038
PC1…. .ACCE…. .INST…. -…… -…. _9000040
PC1…. .ACCE…. .FREQ…. -…… -…. _9000039
PC1…. .ACCE…. .SPEC_OSCI. -…… -…. _9000041
PC2…. .TRANSFERT. FREQ…. _9000042. _9000043. _9000044
PC2…. .ACCE…. .INST…. -…… -…. _9000046
```

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```
PC2…. .ACCE…. .FREQ…. -…… -…. _9000045
PC2…. .ACCE…. .SPEC_OSCI. -…… -…. _9000047
PC3…. .TRANSFERT. FREQ…. _9000048. _9000049. _9000050
PC3…. .ACCE…. .INST…. -…… -…. _9000052
PC3…. .ACCE…. .FREQ…. -…… -…. _9000051
PC3…. .ACCE…. .SPEC_OSCI. -…… -…. _9000053
```

The parameter of the table indicating the check-point is named GROUP_NO to be homogeneous with the case TABLE. As one saw higher, it is simply about a number of point in the group of meshs of the check-points.

7 Calculation of a load of seismic forces

If TYPE_RESU is worth 'LOAD', the file result of the frequential seismic forces of MISS3D is post-treaty by CALC_MISS in order to provide the temporal request of forces seismic in a direction of space applied to the interface ground (fluid) structure.

7.1 Operand MODEL

It is the model structure to which one adds a super - element including a macro - element obtained starting from the temporal or frequential evolution of the impedance of the field of ground (and possibly of the fluid field) obtained using the chain *Code_Aster* – MISS3D by the option TYPE_RESU=' FICHIER_TEMPS' or TYPE_RESU=' FICHIER' of CALC_MISS .

7.2 Operand FONC_SIGNAL

Signal of temporal imposed displacement, generally obtained by double temporal integration of a accélérogramme. This last generally corresponds in the data of the chain *Code_Aster* – MISS3D with an acceleration imposed on the surface of the ground in far field. Integrations can be obtained directly in the transitory field by means of the operator CALC_FONCTION with the keyword JUST.

7.3 Operand UNITE_RESU_FORC

Allows to define the logical unit of the generated file which will contain the frequential seismic forces calculated with the option TYPE_RESU=' FICHIER' of CALC_MISS.

7.4 Operand FREQ_MAX

This operand provides the value of cut-off frequency for the calculation of the temporal seismic force obtained by the combination of the frequential seismic forces (indicated by UNITE_RESU_FORC) and of the signal in imposed displacement indicated by FONC_SIGNAL.

7.5 Operand NOM_CMP

This operand provides the component, to choose between 'DX', 'DY' and 'DZ', giving the direction of the seismic request.
One calculates a load for only one direction at the same time. In the case of simultaneous requests in several directions, it is then necessary to create as many different loads with the option TYPE_RESU=' CHARGE' of CALC_MISS.

7.6 Operand GROUP_NO_AFFE

This operand provides list of groups of nodes where the seismic load is imposed. These nodes can be real, for example the central node of a foundation solidarized by a relation LIAISON_SOLIDE, or

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fictitious corresponding to modal coordinates connected to the physical coordinates of the dynamic interface of the macronutrient of ground by a relation LIAISON_INTERF.

7.7 Operand ISSF

This operand indicates if one has or not a field of fluid.

7.8 Operand VARI

This operand makes it possible to activate or not the features of space variability as in the operator DYNA_ISS_VARI.

7.9 Operand UNITE_RESU_IMPE

Allows to define the logical unit of the generated file which will contain the frequential impedances calculated with the option TYPE_RESU=' FICHIER' of CALC_MISS.

7.10 Keyword INTERF

7.10.1 Operand MODE_INTERF

```
♦  MODE_INTERF  =  /  'ALL',
                   /  'CORPS_RIGI'
                   /  'UNSPECIFIED'
```

This operand makes it possible to characterize the type of modes of interface of the model. Three types of modes of interface are possible: if one chooses a modeling being based on the six modes of rigid body, one must inform 'CORPS_RIGI', if one works with all the modes of interface (unit modes finite elements), one informs 'ALL'. For all the other cases of foundation (inserted geometry, modes of unspecified representation for flexible foundation, case ISSF=' OUI'), one informs 'UNSPECIFIED'.

7.10.2 Operand GROUP_NO_INTERF

```
♦  GROUP_NO_INTERF  =  gr_inter
```

With this keyword, one defines the group of nodes being pressed on the surface meshs constitutive of the interface ground-structure.

7.11 Mot_clé MATR_COHE

7.11.1 Operands VITE_ONDE and PARA_ALPHA

♦ TYPE = model

One can choose between the function of coherence of Became moth-eaten & Luco (MITA_LUCO) and that of Abrahamson for hard ground (ABRAHAMSON). If one chooses MITA_LUCO, then one can inform:

◊ VITE_ONDE = c_{app}

◊ PARA_ALPHA = α

They are the parameters of the function of coherence of Luco and Wong (pure inconsistency without the effect of the passage of wave):

$$\gamma(d)=\exp[-(\alpha.f.\frac{d}{c_{\text{app}}})^2]$$

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where *D* indicate the distance between two items I and J on the foundation, f is the frequency and c_{app} speed connects propagation on the surface of wave HS (for example $200-600\mathrm{m}/s$). The parameter α is generally taken equal to 0.5 (defect). The value of defect for `VITE_ONDE` is worth 600.

7.12 Keyword `MATR_GENE`

7.12.1 Operands `BASE, NUME_DDL_GENE`

♦ `LOWE = base`

Name of the concept bases modes of interface.

♦ `NUME_DDL_GENE= numgen`

Name of the concept generalized classification being based on the preceding modal base. In general with a full storage

7.13 Operand `PRECISION`

◊ `PRECISION = prec`

This parameter is by default taken equal to 0.999.

For the calculation of the seismic forces with space variability of the incidental field, one carries out the spectral decomposition of the matrix of coherence $[\gamma_{ij}]$, $i=1...,M$. The parameter `prec` give the share of “the energy” of the matrix which one preserves by retaining only one reduced number of clean vectors. If one indicates by $K \ll M$ the number of eigenvalues selected (one retains them K greater eigenvalues), one has

$$\mathrm{prec}=\frac{\sum_{i=1}^{K} \lambda_i^2}{\sum_{i=1}^{M} \lambda_i^2}$$

8 Others

8.1.1 Operand `INFORMATION`

Level of detail of impression of the order.
With `INFO=2`, many information on the sequence of the stages of calculation is displayed.

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