

Manuel d'Utilisation
U4.0- booklet: Use of the orders
Document: U4.01.04

Innovations and modifications of version 8

Summary:

The object of this document is to give a comprehensive view of the modifications of syntax and new opportunities of the orders of *Code_Aster* intervened during the development of version 8, i.e. since version 7.4.

The index B of this document thus mentions changes introduced since **version 8.4** from June 2006 and valid for **version 8.4** from December 2006.

Paragraphs 2 and, respectively 3, treat syntactic evolutions between version 8.2 (December 2005) and 8.3 (June 2006) and, respectively between versions 8.0 (December 2004) and 8.2.

For more precise details, one will consult the documentation of the orders and the file `histor` corresponding under-version (e.g.: [8.3.7], section *Development* site `www.code-aster.org`). The impacted orders are listed alphabetically.

1 Innovations between 8.3 and 8.4

1.1 New orders

1.1.1 MACR_SPECTRE

It is about an macro-order of calculation of spectra of floor in several nodes, in postprocessing of a seismic calculation. It connects the following stages (cf [8.3.21], documentation [U4.32.11]):

- recovery of the relative acceleration of the various nodes,
- combination with the acceleration of training to obtain absolute acceleration,
- calculation of spectra of answer for several depreciation,
- envelope of the tablecloths corresponding to the same floor to obtain the spectrum of floor.

1.1.2 POST_GP

The object of this order is to gather the various stages of a postprocessing of which the goal is to calculate the energy criterion G_p at the conclusion of a thermomechanical calculation. Either one identifies the breaking values of the G_p parameters typically according to critical tenacities data at a temperature fixed (on a calculation of test-tube CT), or one estimates the moments of rupture on a transient starting from the breaking values of G_p previously identified (cf [8.3.14], documentation [U4.82.31]).

1.1.3 POST_K_TRANS

This order connects the calculation of the modal stress intensity factors (option K_G_MODA of $CALC_G$) and the calculation of $K(T)$ in postprocessing of a transitory mechanical calculation on the basis of modal fissured structure (cf [8.3.10], documentation [U4.82.30]).

1.1.4 SIMU_POINT_MAT

Allows to simply carry out quasi-static nonlinear mechanical calculations on a material point. Calculation is in fact carried out on a tetrahedron. As starter the history of the loading, material and behavior, and the moments of calculation (cf [8.3.11] are defined, documentation [U4.51.12]).

1.1.5 Versions of the tools

The version of the tool of refinement/déraffinement for grid `lobster` used is the 8.5.
The version of the library `med` used for the data exchange is the 2.3.1.

1.2 General modifications

The variables of orders (field of parameters of mechanical calculation) of standard corrosion, hydration and irradiation are provided in `AFFE_MATERIAU` under the keyword `AFFE_VARC` since version 8.3 (cf general modifications in 8.3). Drying, the deformations unelastic and the metallurgy join same logic (cf [8.3.10]).
Remain the temperature...

Keywords `SECH_CALCULEE` and `EPSA_CALCULEE` thus disappear from `AFFE_CHAR_MECA`.

1.3 Resorptions

Orders COMB_CHAM_NO and COMB_CHAM_ELEM combination of fields and recombination of Fourier treated. They are removed with the profit of CREA_CHAMP and CREA_RESU (cf [8.3.12]).

Modeling 3D_JOINT_CT was reabsorbed.

The law of behavior POLY_CFC is removed, replaced by POLYCRYSTAL, richer.
The order DEFI_TEXTURE is removed.

The standard obstacle disappears, the order DEFI_OBSTACLE product an object of the type `table_fonction` that one can handle with the classical operators dealing with the tables.

1.4 Modified orders

1.4.1 Behavior of the nonlinear operators

For the laws of behavior, a similar keyword, in general, is added/modified in the order DEFI_MATERIAU.

Automatic step division of time:

- New keywords starting with SUBD_... allowing for choice of the method of cutting used and to define the arguments of them. The method existing before is called UNIFORM, automatic method EXTRAPOLATE. This last tent to determine by extrapolation the number of subdivision and the ratio to apply to converge with the iteration count asked.
- The orders concerned are STAT_NON_LINE, DYNA_NON_LINE, DYNA_TRAN_EXPLI, CALC_PRECONT, MACR_ASCOUF_CALC, MACR_ASPIC_CALC, MACR_CABRI_CALC, SIMU_POINT_MAT.

New behavior GLRC_DAMAGE and GLRC_DM :

- GLRC_DAMAGE is a model of behavior of the reinforced concrete plates written in efforts generalized with damage in inflection. Replace model GLRC present before. The formulation of the model is the same one as in Europlexus.
- GLRC_DM is also a model of total damage. He takes into account the coupling membrane/inflection for the damage but damage and plasticity are not coupled. The applications concerned are the seismic analyses of the reinforced concrete structures.

New behavior VMIS_ISOT_PUIS :

- It is the elastoplastic behavior with criterion of Von Mises with isotropic work hardening following a law power.

Examination of the structural analyses in civil engineer:

- New options were introduced into CALC_ELEM : EPVC_ELNO/ELGA whose components are the thermal deformations, the withdrawal of dessication and the endogenous withdrawal.
- New options EPFP_ELNO/ELGA calculate the clean deformation of creep for models BETON_UMLV and GRANGER.
- Options EPFD_ELNO/ELGA calculate the deformation of creep of dessication.
- Options EPGR_XXXX are removed.

DEFORMATION=' REAC_GEOM' new:

- Treatment of the multifibre beams (element `POU_D_TGM`) into large displacements and great rotations with geometrical reactualization and an assumption of small deformations without neglecting geometrical rigidity (cf [8.3.4]).

Parameter PARM_THETA :

- This parameter suitable for the behavior is moved under `COMP_INCR` in logic of what was made for the local convergence criteria (cf § modifications in version 8.2).

1.4.2 Keyword SUIVI_DDL

This new keyword, available under `STAT_NON_LINE` / `DYNA_NON_LINE`, allows to follow during calculation the value in a point or a extremum of a component of a field (cf [8.3.3]).

1.4.3 Keyword SOLVEUR

This keyword is common to the operators `DYNA_LINE_TRAN`, `DYNA_NON_LINE`, `MECA_STATIQUE`, `STAT_NON_LINE`, `THER_LINEAIRE`, `THER_NON_LINE`.

METHODE=' MUMPS' /SCALING and RENUM new:

- `SCALING` control the type of preprocessing to be operated with the system “to balance it”. `RENUM` allows to choose the type of renumerotation (cf [8.3.1]).

1.4.4 AFFE_CARA_ELEM

HULL/VECTOR new:

- Allows to define the vector directing the local reference mark of the hulls by its coordinates without passing by `ANGL_REP` (cf [8.3.5]).

SOLID MASS/ANGL_EULER new:

- Allows to define the vector directing the local reference mark of the solid elements into orthotropic by giving the angles of Euler instead of the nautical angles (`ANGL_REP`) (cf [8.3.11]).

DISCRETE/VALE_F new (for the elementary characteristics of the discrete elements):

- Allows to carry out a calculation of sensitivity compared to a term of the elementary matrix of the elements `DISCRETE` and `DISCRET_2D`, limited to the matrix of stiffness and mass (cf [8.3.13]).

1.4.5 AFFE_CHAR_MECA/AFFE_CHAR_MECA_F

NOM_CHAM, COEF_IMPO, COEF_MULT_ESCL removed:

- These keyword were used to define unilateral conditions in THM in particular. The keyword should now be used LIAISON_UNILATER (cf [8.3.3]).

FOND_FISSURE new (contact continuous method):

- Allows to correctly treat the contact in bottom of crack if one uses elements of Barsoum (cf [8.3.3]).

RACCORD_SURF new (contact continuous method):

- Allows to correctly treat the contact in the presence of a connection by LIAISON_MAIL (cf [8.3.3]).

COEF_MULT_FONC new:

- Allows to define coefficients functions in one LIAISON_DDL (cf [8.3.18]).

1.4.6 AFFE_MATERIAU

AFFE_NOEUD new:

- Development in hand for the assignment of properties materials to the nodes of the elements for the THM (cf [8.3.2]).

LIST_NOM_VARC new possibilities:

- The new variables of order are SECH for drying, EPSA for the unelastic deformations, M_ACIER and M_ZIRC for the metallurgical phases (cf § general modifications and [8.3.10]).

1.4.7 AFFE_MODELE

SUPER_MAILLE replace MESH :

- Homogenisation of the vocabulary, one uses the keyword now SUPER_MAILLE when it is about under-structuring (cf [8.3.20]).

1.4.8 CALC_ELEM

REPE_COQUE new:

- One finds under this keyword factor the parameters of definition of the local reference mark of examination of the elements of hulls similar to those of AFFE_CARA_ELEM. Postprocessing can thus be carried out in reference marks different by groups from meshes (cf [8.3.21]).

New options ARCO_ELNO_SIGM/ARCO_NOEU_SIGM

- These options calculate the constraints of arc and console useful for the examination in local reference mark on the faces of a structure 3D. This is in particular used for the analysis of the constraints on the skin of the stoppings (cf [8.3.21]).

INDI_ERRE re-elected in INDI_ERREUR

- To be in coherence with CALC_NO (cf [8.3.5]).

1.4.9 CALC_FATIGUE

New criterion VMIS_TRESCA :

- Calculate the amplitude of maximum variation of a tensor of constraint (cf [8.3.18]).

Modifications of the names of criterion:

- MATAKE becomes MATAKE_MODI_AC, DOMM_MAXI becomes MATAKE_MODI_AV and FATEMI_SOCIE becomes FATESOCI_MODI_AV (cf [8.3.18]).

1.4.10 CALC_FONCTION

NORMALIZES value by default removed:

- To avoid any risk of error, there is no more value by default for this keyword for the operation SPEC_OSCI (cf [8.3.21]).

1.4.11 CALC_G

NUME_FOND new:

- In the event of bottom of crack multiples with X-FEM, allows to choose the bottom of crack which one post-draft (cf [8.3.4]).

New option: CALC_K_MAX

- The opening from the closing of the cracks makes it possible to distinguish what does not allow CALC_G_MAX (cf [8.3.10]).

New method of smoothing: LAGRANGE_REGU

- Mitigate the disadvantages of the method of smoothing LAGRANGE for the closed funds of crack, for which method LEGENDRE is not applicable, or for cracks nonwith a grid (X-FEM) (cf [8.3.11]).

Suppression of MODEL, CHAM_MATER, DEPL, QUICKLY, ACCE

- Information is directly extracted from the concept RESULT as starter of the order in order to avoid any risk of error (even logical that CALC_ELEM/CALC_NO) (cf [8.3.20]).

1.4.12 CREA_CHAMP

OPERATION, new possibilities: R2C, C2R

- The option R2C respectively allows to produce a complex field starting from a real field with worthless imaginary part. The option C2R allows to extract the real or imaginary part of a complex field (cf [8.3.12]).

COEF_C new

- For the operation ADZE, allows to apply a coefficient complexes with the values of a field (cf [8.3.12]).

1.4.13 CREA_TABLE

TYPE_TABLE new

- In order to identify the tables which contain names of functions, the type was introduced table_fonction (cf [8.3.17]). Note: one can extract these functions with the order RECU_FONCTION, and to print them directly with the order IMPR_TABLE, option IMPR_FONCTION=' OUI '.

1.4.14 DEFI_COMPOR

FAMI_SYS_GLIS, new possibility: BCC24

- Family of system of slip specific to bainitic steels (cf [8.3.11]). Parameters H1 with H6 were introduced are `DEFI_MATERIAU` under `ECRO_ISOT1` to define the matrix of interaction enters the systems of slip.

ANGL_EULER new:

- See `AFFE_CARA_ELEM` (cf [8.3.11]).

1.4.15 `DEFI_INTERF_DYNA`

DDL_ACTIF removed:

- Only the option `MASK` is usable (cf [8.3.3]).

1.4.16DEFI_MALLAGE

SUPER_MAILLE and **DEFI_SUPER_MAILLE** replace **MESH** and **DEFI_MAILLE** :

- See **AFPE_MODELE** (cf [8.3.20]).

1.4.17BEGINNING/CONTINUATION

SD_VERI new:

- For submission to the developers: start the checking of the structures of data during calculation (cf [8.3.2]).

1.4.18DEPL_INTERNE

SUPER_MAILLE replace **MESH** :

- See **AFPE_MODELE** (cf [8.3.20]).

1.4.19EXEC_LOGICIEL

GRID new:

- Allows to carry out a geometrical data file in order to produce the grid by calling the maillor directly since the command set Aster (cf [8.3.10]). If that can have an interest in certain studies, parametric in particular, it is more advisable to produce the grid, and to check it before the launching of the study Aster.

1.4.20IMPR_RESU

UNIT by default with the format **GMSH**

- The unit by default with the format **GMSH** is now 37 which corresponds to the type `pos` in `astk` (cf. [8.3.21]).

1.4.21LIRE_IMPE_MISS/MACRO_MISS_3D

TYPE = 'BINARY' new:

- In order to improve the performances of reading of the impedances coming from `Miss3D`, one can use a binary format (cf [8.3.13]).

1.4.22LIRE_MALLAGE

RE-ELECT new:

- Allows the reading of a grid `FORMAT='MED'` to re-elect certain names of groups of meshes or nodes. One can thus remove possible conflicts between the names of groups

MED which can be written on 32 characters whereas in *Code_Aster*, they are limited to 8 characters. (cf [8.3.22]).

1.4.23MACRO_MATR_ASSE

CHAR_CINE new:

- Taking into account of boundary conditions of the type loads kinematics (cf [8.3.1]).

1.4.24 MACR_ADAP_MAIL

SENSITIVITY new:

- It is now possible to adapt a grid according to the derivative of a field (cf [8.3.20]).

1.4.25 MACR_ELEM_STAT

PROJ_MESU, MODE_MESURE new:

- Allow, starting from measured information, to consider the modes clean of a structure following a structural modification (cf [8.3.20]).

1.4.26 MACR_RECAL

LIST_DERIV new:

- Allows to use the derivative exits of the calculation of SENSITIVITY ; it is possible to mix finished differences and sensitivity (cf [8.3.8]).

FUNCTIONAL METHOD/GRADIENT//INTER_FONC_MAXI new:

- These keywords make it possible to parameterize the new algorithms of retiming available (cf [8.3.20]).

POSTING new:

- Allows to choose when the graphs (cf [8.3.20]) are displayed.

1.4.27 MODI_MAILLAGE

MODEL removed:

- It is not necessary any more to give the model to direct meshes, the keyword was removed (cf [8.3.6]).

1.4.28 NORM_MODE

MASS, STIFF, AMOR new:

- Allows to renormaliser the modes of a concept `base_modale`, bases of Ritz for example (cf [8.3.20]).

1.4.29 POST_RCCM

TABL_RESU_PRES new:

- Jointly with the presence of `TABL_RESU_THER`, calculates it criterion of the thermal ratchet for the option activates `EVOLUTION` (cf [8.3.16]). For the option `UNIT`, the criterion of the thermal ratchet is calculated on the presence of `RESU_THER`.

SY_MAX new:

- Conventional of elasticity, alternative limit with the value SY_02 present in material RCCM (cf [8.3.16]).

1.4.30 PROJ_CHAMP

NOM_PARA new:

- to see PROJ_MESU_MODAL (cf [8.3.2]).

TRANSF_GEOM_2 new:

- To define 2 or 3 functions (fx, fy, fz) of the geometrical transformation applied to MODELE_2 before projection (cf [8.3.2]).

1.4.31 PROJ_MESU_MODAL

NOM_PARA new:

- Allows to select the data which will be preserved in the structure of data result (cf [8.3.2]).

TRANSF_GEOM_2 new:

- To define 2 or 3 functions (fx, fy, fz) of the geometrical transformation applied to MODELE_2 before projection (cf [8.3.2]).

1.4.32 PROJ_SPEC_BASE

TOUT_CMP new:

- Allows to take into account the total adimensional spectrum and not only one component of the modal deformation (cf [8.3.8]).

1.4.33 PROPA_XFEM

METHOD and **RAY** new:

- The scope of application of the order is extended to the propagation 3D of the cracks in mixed mode on unspecified or hexahedral tetrahedral grids with face opposite parallels (cf [8.3.9]).

1.4.34 RECU_FONCTION

TABLECLOTH new:

- Allows to extract a function from a tablecloth for one VALE_PARA_FONC given (cf [8.3.21]).

1.4.35 REST_BASE_PHYS

GROUP_NO, **NODE**, **GROUP_MA**, **MESH** new:

- Allow to make a restitution of a concept generalized on physical basis only in certain nodes (cf [8.3.20]).

1.4.36 TEST_RESU

VALE, VALE_I, VALE_R new behavior:

- One can validate a result if it corresponds to one of the provided values (cf [8.3.17]).

2 Innovations between 8.2 and 8.3

2.1 General modifications

The variables of orders corrosion, hydration and irradiation are not provided any more in AFFE_CHAR_MECA but in AFFE_MATERIAU under the keyword AFFE_VARC. This will make it possible to extend the number and the type of the variables of orders. In the long term, the unelastic temperature, drying and deformations should be melted in this mould (cf [8.1.4, 8.2.18]).

2.2 New orders

2.2.1 CALC_G

Orders CALC_G_THETA_T and CALC_G_LOCAL_T were amalgamated in a single order CALC_G.

2.2.2 POST_MAIL_XFEM / POST_CHAM_XFEM

The order POST_MAIL_XFEM allows to generate a grid fissured starting from a healthy grid and crack X-FEM. This grid is only produced with goal of visualization and does not have to be used for a calculation.

The order POST_CHAM_XFEM use this fissured grid and allows to create a field of displacement associated with the fissured grid. This field of displacement could be then visualized (IDEAS, GMSH...).

2.3 Resorptions

The following features were reabsorbed in version 8.3:

- Law of behavior CHABOCHE : the model VISC_CIN2_CHAB allows, inter alia, to make the same thing,
- Law of OHNO : to deal with the problems of progressive deformation, it is advised to use the elastoplastic or elastoviscoplastic model of TAHERI,

- Laws of behavior THM: ELAS_THM, SURF_ETAT_SATU, SURF_ETAT_NSAT, CAM_CLAY_THM, LIQU_SATU_GAT, LIQU_NSAT_GAT,
- Modelings APPUI_REP and ASSE_GRIL,
- Orders POST_SIMPLIFIE, DIST_LIGN_3D, DEFI_THER_JOULE,
- Option of calculation INDU_MUTU.

2.4 Modified orders

2.4.1 Laws of behavior of the nonlinear operators

In general, a similar keyword is added/modified in the order DEFI_MATERIAU.

HOEK_BROWN modified:

- In THM, one distinguishes now HOEK_BROWN_EFF (the criterion of plasticization being formulated in effective constraints) and HOEK_BROWN_TOT (even criterion formulated in total constraints). No change in pure mechanics (cf [8.2.1]).

ELAS_HYPER new:

- Law of behavior very-rubber band of Signorini (Mooney-Rivlin) (cf [8.2.8]).

IRRAD3M new:

- Law of behavior of steels under irradiation (cf [8.2.9]).

DIS_GRICRA modified:

- The parameters of the connection grid-pencil were largely modified in order to be more easily identifiable and to improve integration of the law itself (cf [8.2.17]).

DEFORMATION= ' COROTATIONNEL' new:

- Great deformations in corotationnelle formulation for the coupling Aster-Zmat (cf [8.2.12]).

2.4.2 AFFE_CARA_ELEM

NODE, MESH, GROUP_NO, GROUP_MA moved

- These keywords are accessible according to whether the characteristic of the discrete elements is “_N” or “_L” (cf [8.2.16]).

2.4.3 AFFE_CHAR_MECA/AFFE_CHAR_MECA_F

DIST_POUTRE/DIST_COQUE and CARA_ELEM new:

- The taking into account during the treatment of the contact of a game allows corresponding to the ray of the beam (section circular) or to the thickness of the hull (cf [8.2.6, 8.2.16]).

METHOD = 'GPC' new:

- The method of the gradient combined project for the contact is the iterative version of the method of the active constraints which takes all its direction (performance in terms of memory capacity and time of resolution) when the number of connection of contact is large (cf [8.2.9]).

LIAISON_UNILATER new:

- Allows to impose a unilateral condition on an unspecified ddl (cf [8.2.12]).

VECT_ORIE_POU new:

- Allows to lay down the direction of the beams in the event of contact beam-beam (cf [8.2.19]).

FACE_IMPO/SANS_GROUP_MA, SANS_MAILLE new:

- Allows to exclude the nodes from certain meshes of the condition imposed to avoid the redundant relations (cf [8.2.17]).

2.4.4 AFFE_MODELE

Modeling: C_PLAN_X, D_PLAN_X

- Modeling XFEM in constraints and deformations plane (cf [8.2.1, 8.2.14]).

Modelings: 3D_THH2MD, 3D_THH2MS...

- Extension to the 3D of modelings HH2 (cf [8.2.9]).

2.4.5 CALC_ELEM

QIRE_EL. _SIGM, QIZ2_EL. _SIGM new options associated with the keyword RESU_DUAL :

- Indicators of error in quantity of interest (cf [8.2.16]).

2.4.6 CALC_G

SMOOTHING = 'LAGRANGE_NO_NO' new:

- Value with the nodes of the indicator of error in quantity of interest (cf [8.2.16]).

2.4.7 CALC_NO

QIRE_NOEU_ELEM new option:

- Indicators of error in quantity of interest (cf [8.2.16]).

2.4.8 CALC_TABLE

ACTION new:

- This keyword factor makes it possible to apply in their order of appearance several operations (cf [8.2.11]).

REGEXP new:

- Allows to filter the lines of a table by applying a regular expression to a column of type text (cf [8.2.16]).

SENSITIVITY new:

- Gives access a derived table (for example resulting from a postprocessing of the derivative of a result) (cf [8.2.16]).

2.4.9 CREA_CHAMP

OPERATION=' NORMALE' new:

- Product a field with the nodes of the normals to the elements (cf [8.2.13]).

2.4.10 CREA_TABLE

SENSITIVITY new:

- Allows to produce a table with the sensitive label (i.e. as if it were the derivative of another table compared to a parameter) (cf [8.2.5]).

2.4.11 DEFI_FOND_FISS

FOND_SUP , FOND_INF new:

- Allows to define the bottom of crack by two lists of nodes, each one referring to a lip (cf [8.2.1]).

PREC_NORM new:

- The precision defines with which one searches the nodes belonging to the normal with the face of crack. This operation was made before in POST_K1_K2_K3 (cf [8.2.20]).

2.4.12 TO_DESTROY

SENSITIVITY new:

- Allows to destroy a significant concept (cf [8.2.16]).

2.4.13 DYNA_LINE_HARM

- The order is now réentrante (cf [8.2.1]).

2.4.14 DYNA_LINE_TRAN

ACCE_INIT new:

- Allows to provide an initial field of acceleration (cf [8.2.3]).

SOLVEUR modified:

- Homogenisation with the other orders (cf [8.2.11]).

2.4.15 DYNALNONLINE

ETAT_INIT/ACCE new:

- Allows to provide an initial field of acceleration (cf [8.2.3]).

LIST_AMOR new:

- Allows to give a list of damping resulting from DEFI_LIST_REEL (cf [8.2.1]).

MODI_EQUI new:

- Specify if one modifies the equilibrium equation or not. If MODI_EQUI=' OUI ', a complete diagram HHT is used; if MODI_EQUI=' NON ', one uses diagram HHT such as it was up to now (cf [8.2.7]).

CRIT_FLAMB new:

- Allows to carry out an analysis of stability on the matrix of reactualized stiffness (cf [8.2.11]).

MODE_VIBR new:

- Vibratory modal analysis on the total matrices (cf [8.2.11]).

DIFF_CENT replace NEWMARK :

- The diagram centered differences does not require any more parameters (cf [8.2.11]).

TCHAMWA new:

- Diagram of integration in dissipative time (cf [8.2.11]).

2.4.16 DYNALTRANEXPLI

ETAT_INIT/ACCE new:

- Allows to provide an initial field of acceleration (cf [8.2.3]).

MASS_DIAG new:

- Allows to use the matrix of diagonal mass (cf [8.2.12]).

MASS_GENE, RIGI_GENE, AMOR_GENE new under PROJ_MODAL

New EXCIT_GENE :

- Explicit resolution starting from matrices projected on basis of Ritz (cf [8.2.13]).

STOP_CFL new:

- This key word, introduced at the same time as the control of the stability condition on the step of time (known as condition CFL), makes it possible to transform into simple warning a possible error message, if it is considered unjustified (case of elements of which Code_Aster cannot calculate the condition or phenomenon stabilizing in modeling) (cf [8.2.15]).

2.4.17 DYNA_TRAN_MODAL

Definition of the nodes of shocks:

- This one can be done by giving a mesh of the type SEG2 (keyword MESH), or a group of one (only) nets of type SEG2 (keyword GROUP_MA) (cf [8.2.1]).

2.4.18 IMPR_CO

CONCEPT new:

- This keyword factor is created in order to be able to associate the name of a parameter sensitive to a concept (cf [8.2.13]).

2.4.19LIRE_TABLE

TYPE_TABLE removed:

- The tables “under-are not typified any more”, it remains only one type “counts”. This is transparent in the other orders (cf [8.2.2]).

2.4.20MACR_LIGN_COUPE

GROUP_MA, MESH new:

- Limit the extraction of the values to the specified meshes (cf [8.2.20]).

2.4.21MACRO_MISS_3D

New parameters:

- About fifteen keywords correspond to file OPTIMISS and make it possible to define the data of description of the ground in MISS3D (cf [8.2.13]).

2.4.22POST_K1_K2_K3

TYPE_MALLAGE, NB_NOEUD_COUPE new:

- Allows postprocessing on free grids (only the regulated grids were supported before) for which one specifies the number of nodes to be built in the normal direction with the face of crack (cf [8.2.20]).

2.4.23POST_RELEVE_T

OPERATION = 'EXTREMA' new:

- Postprocessing allowing to extract the min and max values from a field as well as the localization of those (cf [8.2.7]).

2.4.24PROJ_CHAMP

Accept the concepts results of the dyna_trans type (produced not DYNA_LINE_TRAN) (cf [8.2.1]).

NUME_DDL new, RIGI_MECA, MASS_MECA, AMOR_MECA removed:

- Allows to impose the classification of DDLs for any type of structure of data and not only mode_meca with the old method using xxxx_MECA (cf [8.2.4]).

2.4.25POST_ELEM

INTEGRAL new :

- Allows to calculate the average and the integral of the component of a field (cf [8.2.12]).

2.4.26POST_RCCM

MX, MX_TUBU new :

- Allows to carry out a calculation RCCM with the unit method by defining two torques of efforts: for pricking, for the pipe (cf [8.2.12]).

2.4.27 REST_BASE_PHYS

CYCLIC new:

- Allows to restore on the complete grid of a structure with cyclic symmetry a calculation carried out on only one sector (cf [8.2.4]).

RESU_PHYS new:

- Restitution of a calculation carried out on the basis of Ritz in DYNA_TRAN_EXPLI (cf [8.2.13]).

2.4.28 STAT_NON_LINE**METHOD = new 'FETI' :**

- Functionality under development, the scope of application is limited (cf [8.2.12]).

3 Innovations between 7.4/8.0 and 8.2

3.1 General modifications

3.1.1 Local convergence criteria

The local convergence criteria are by nature relevant only for a given behavior; the accepted residue, the diagram of integration or the iteration count can now be defined in a way different for each behavior from the model.

As regards syntax, the keywords RESI_INTE_REL, INTER_INTE_REAL, INTER_INTE_MAXI, RESO_INTE are moved of CONVERGENCE towards COMP_INCR/COMP_ELAS (whose occurrence defines each behavior).

The orders concerned are DYNA_NON_LINE, DYNA_TRAN_EXPLI, STAT_NON_LINE and cascades about it the macro-orders CALC_PRECONT, MACR_ASCOUF_CALC, MACR_ASPIC_CALC, MACR_CABRI_CALC.

3.1.2 Solveur MUMPS

A new direct solver is available in *Code_Aster* : MUMPS.

It makes it possible to solve problems known with the classical solveurs when the matrix is not positive (case XFEM, incompressible elements,...).

It is usable by the orders DYNA_NON_LINE, MECA_STATIQUE, RESO_LDLT, STAT_NON_LINE, THER_LINEAIRE and THER_NON_LINE (cf [8.0.14]).

Notice for the version local

This solver does not belong to the sources of Code_Aster, it acts of an external package.

3.1.3 Solveur FETI

Solver FETI is a parallel solver by decomposition of fields.

It is under development; its field of application is thus limited in version 8.2.

3.2 New orders

3.2.1 CALC_TABLE

This order makes it possible to handle the data of `tables` in the manner of a spreadsheet. The order makes it possible to carry out operations on the data of the tables. The currently available operations are:

- concaténer/to combine two tables having common parameters,
- to apply a formula,
- to re-elect parameters,
- to filter the lines according to certain criteria,
- to extract from the columns of a table,
- to order the lines.

3.2.2 INFO_FONCTION/CALC_FONCTION

The order CALC_FONCTION was deeply rewritten so that it is simple and fast to introduce there new generic treatments at the request of the users.

Thus, only the operations which calculate a function (or a tablecloth) starting from other functions were preserved in CALC_FONCTION.

It should be noted that the operation of smoothing wraps spectra of floor (SRO), LISS_ENVELOP, was re-examined according to the regulations of EDF Septen.

All the operations on the functions which produce another thing today (it acts only of table) are now available in the order INFO_FONCTION :

- MAX, RMS, NOCI_SEISME, NORMALIZES and ECART_TYPE.

3.2.3 LIRE_FORC_MISS/LIRE_IMPE_MISS

LIRE_IMPE_MISS and LIRE_FORC_MISS allow respectively to create a generalized matrix and a generalized vector of seismic force starting from the matrix of impedance of ground or the seismic forces of ground created by MISS3D for a frequency of extraction given.

3.2.4 POST_MAIL_XFEM/POST_CHAM_XFEM

3.2.5 MAC_MODES

This order makes it possible to calculate a criterion of orthogonality, the Modal Criterion Insurance, between two modal bases (in general, experimental and a one calculated) (cf [8.1.14]).

3.3 Modified orders

3.3.1 AFFE_CARA_ELEM

CARA_SECT removed:

- Keyword not used (cf [8.0.6]).

RIGI_PARASOL/GROUP_MA_POI1 and GROUP_MA_SEG2 new:

- Allow to define a carpet of springs to model a displacement of foundation, a landslide and to apply boundary conditions in efforts (cf [8.0.17]).

3.3.2 AFFE_CHAR_CINE and AFFE_CHAR_CINE_F

AFFE_CHAR_CINE and AFFE_CHAR_CINE_F are usable with STAT_NON_LINE and DYNA_NON_LINE.

GROUP_MA, MESH new:

- Definition of the zones to be forced (cf [8.0.6]).

3.3.3 AFFE_CHAR_MECA

CONTACT/METHODE=' VERIF ' new:

- Allows to check if there is or not matter interpenetration a posteriori without paying the overcost of the resolution with contact (cf [8.0.7]).

CONTACT/SLIDE , ALARME_JEU new:

- Allows to carry out with the method of the active constraints the “sticking” contact, surfaces in opposite cannot fall apart, by emitting an alarm if the game becomes excessive (value defined by the user) (cf [8.0.7], [8.1.11]).

CONTACT_INIT new:

- This keyword makes it possible to do without artificial stiffnesses blocking the rigid movements of body (cf [8.0.8], [8.0.11]).

CONTACT/COMPLIANCE new:

- Introduction of a microphone-macro model for the interface of contact (effect of roughness on a microscopic scale) (cf [8.1.13]).

CHAMNO_IMPO new:

- Allows to take the contents of one CHAM_NO like second member of the linear relation (cf [8.0.8]).

ELIM_MULT new:

- If one wishes to bind several grids between them (keyword LIAISON_MAIL), one eliminates the redundant conditions now in order to avoid obtaining worthless pivots at the time of the resolution (ELIM_MULT= ' NON '). So in certain typical cases, one does not want to eliminate these conditions, one can modify the value by default (cf [8.0.3]).

LIAISON_CYCL new:

- Application of cyclic condition of symmetry with dephasing (cf [8.0.8]).

PRESSION_CALCULE removed:

- EVOL_CHAR fact the same thing and accepts other types of fields (cf [8.1.19]).

VERI_DDL removed:

- The inexpensive checking is henceforth systematic (cf [8.1.19]).

3.3.4 AFFE_MATERIAU

AFFE_VARC new:

- The variables of orders are now provided in AFFE_MATERIAU and either in the operators of resolution DYNA_NON_LINE/STAT_NON_LINE (cf [8.1.4]).

3.3.5 AFFE_MODELE

New modelings PLAN_ELDI, PLAN_JOINT, AXIS_ELDI, AXIS_JOINT :

- XXX_JOINT replace to distinguish the elements JOINT elements with internal discontinuity ELDI (cf [8.0.18]).

New modelings :

- These modelings known as “selective” rest on a diagram of integration at the tops for the terms of the capacitive type, and at the points of Gauss for the terms of the diffusive type (cf [8.1.10]).

3.3.6 CALC_ELEM

DURT_ELGA_TEMP removed:

- Calculations are now carried out with the nodes (DURT_ELNO_TEMP) (cf [8.0.14]).

3.3.7 CALC_FATIGUE

COEFF_PREECROU new:

- This parameter makes it possible to take into account a précrouissage in the criteria of MATAKE, DANG_VAN_MODI_AC/AV and DOMM_MAXI (cf [8.0.3]).

3.3.8 CREA_MAILLAGE

CREA_FISS new:

- Allows to generate meshes QUAD4 (to associate with it finite elements with discontinuity) starting from groups of nodes (cf [8.0.13], [8.0.18]).

QUAD_LINE new:

- Transformation of quadratic meshes into linear meshes (cf [8.0.13]).

3.3.9 CALC_FATIGUE

CRITERION = 'FATEMI_SOCIE' new:

- Addition of the criterion of Fatemi and Socie in elasticity and plasticity (cf [8.1.5]).

3.3.10 CALC_FLUI_STRU

AMOR_REDUIT_CONN new:

- Method of Connors for the analysis of the vibratory behavior of the tubes of Steam Generator (cf [8.1.1]).

3.3.11 CALC_G_LOCAL_T/CALC_G_THETA_T

OPTION = 'K_G_MODAL' new:

- Calculation of the modal stress intensity factors (cf [8.1.17]).

3.3.12 CALC_META

META_INIT, META_ELGA_TEMP removed:

- To suppose that the families of points of integration are the same ones for metallurgical calculation and mechanical calculation was not very healthy. The calculations are now done with the nodes. META_INIT is thus replaced by META_INIT_ELNO and META_ELGA_TEMP is removed, META_ELNO_TEMP by default (cf [8.0.14] is calculated).

3.3.13 CREA_CHAMP

EXTR/TABLE new:

- Allows to create a field starting from data contained in one table (cf [8.1.17]).

3.3.14 BEGINNING/CONTINUATION

ERROR new:

- Allows to raise an exception Python instead of stopping on the level of FORTRAN (useful only for particular macro-orders) (cf [8.1.20]).

IMPR_MACRO new:

- Allows to choose the view of the orders launched by an macro-order which is now disabled by default (cf [8.1.13]).

RESERVE_CPU new:

- Allows to ensure itself to have a minimum of time for the last stages of calculation (closing of the base, transfer of the results) (cf [8.0.13]).

3.3.15DEFI_BASE_MODAL

ORTHO_BASE new:

- Réorthogonaliser a modal base obtained by concatenation of several bases allows, the colinéaires modes can be eliminated by EXTR_MODES (cf [8.1.7]).

3.3.16DEFI_FISS_XFEM

CONTACT , INTEGRATION new:

- Modeling of the contact on the lips of the crack with the method continues (cf [8.0.6]) and choice of the method of integration to the nodes on the facets of contact (cf [8.1.7]).

RAYON_ENRI new:

- Allows to define a ray delimiting the zone of enrichment of the nodes in bottom of crack (cf [8.1.19]).

ALGO_LAGR new:

- Selection of the algorithm of choice of the space of Lagranges for the contact with X-FEM (cf [8.1.19]).

3.3.17DEFI_FLUI_STRU

CSTE_CONNORS , RHO_TUBE , NB_CONNORS new:

- Method of Connors for the analysis of the vibratory behavior of the tubes of Steam Generator (cf. [8.1.1]).

3.3.18DEFI_GROUP

DETR_GROUP_MA/DETR_GROUP_NO new:

- Allow to destroy existing groups, one can if need be create groups of same names (cf [8.1.6]).

3.3.19DEFI_MATERIAU

RUPT_FRAG , RUPT_FRAG_FO new:

- Definition of the parameters of the law of Barenblatt (tenacity, critical stress and jump of displacement) function of the temperature (cf [8.0.1]).

LEMAITE_IRRA , LMARC_IRRA , GRAN_IRRA_LOG replace GRAN_IRRA , FLU_IRRA :

- Definition of the parameters of the various laws which one found before under the name ASSE_COMBU (cf [8.0.8]).

GATT_MONERIE new:

- New law of élasto-viscoplastic thermomechanics of the fuel (cf [8.0.16]).

BETON_REGLE_PR new:

- Lawful concrete law known as “right-angled parabola” (cf [8.0.17]).

HOEK_BROWN new:

- Law of behavior of Hoek-Brown modified for the rock mechanics analysis (cf [8.1.1]).

CABLE modification:

- The elastic parameters must be provided under the keyword ELAS (cf [8.1.17]).

3.3.20DYNA_NON_LINE

See STAT_NON_LINE.

3.3.21EXTR_MODES

SEUIL_X/_Y/_Z new:

- Allows to select the modes on a directional criterion (cf [8.1.17]).

3.3.22 GENE_MATR_ALEA

MATR_MOYEN new:

- Allows to generate one `macr_elem_dyna` random starting from a median value (cf [8.1.8]).

3.3.23 IMPR_GENE

FORMAT, UNIT moved:

- Back up before under the keyword factor GENE (cf [8.0.21]).

3.3.24 IMPR_RESU

PART new:

- Selection the real or imaginary part during the impression of complex fields allows (cf [8.1.1]).

GROUP_MA, MESH, GROUP_NO, NODE new:

- Selection of topological entities added for format MED (cf [8.1.13]).

3.3.25 LIRE_RESU

POSI_AMOR new:

- With the format IDEAS (unv), allows to recover reduced damping (cf [8.1.17]).

3.3.26 MACR_CABRI_MAIL

FILE removed:

- Was not used any more (cf [8.0.6]).

3.3.27 MACR_LIGN_COUPE

LIGNE_COUPE/VECT_Y new:

- Allows to define a local reference mark for postprocessing (cf [8.1.6]).

3.3.28 MACR_RECAL

GRAPH/FORMAT new:

- Allows to produce the curves with the format Xmgrace or Gnuplot (cf [8.1.22]).

3.3.29 MECA_STATIQUE

NUME_COUCHE, NIVE_COUCHE, ANGLE and PLAN removed:

- These keywords were used for the calculation of certain options which are not calculated any more by MECA_STATIQUE but CALC_ELEM/CALC_NO (cf [8.0.5]).

3.3.30 MODI_MODELE_XFEM

CRITERION new:

- Allows to remove the ddl of jump to avoid a bad conditioning of the matrix (cf [8.1.7]).

3.3.31 POST_K1_K2_K3

SYME_CHAR new:

- Allows to take into account the symmetry of modeling in the calculation of the stress intensity factors (cf [8.0.6]).

3.3.32 PROJ_CHAMP

PROL_ZERO new:

- Allows to prolong the fields projected by zero where the initial field is not defined (cf [8.1.4]).

3.3.33 STAT_NON_LINE

VARI_COMM removed:

- The variables of orders are provided in AFFE_MATERIAU (cf [8.1.4]).

POSTING new:

- Personalization of the posting of the table of convergence (cf [8.1.11]).

3.3.34 TEST_FONCTION

VALE_ABS new:

- To test the absolute value of a result (cf [8.1.1]).

3.3.35 TEST_RESU

RESU_GENE new:

- To test the concepts resu_gene (cf [8.0.19]).

VALE_ABS new:

- To test the absolute value of a result (cf [8.1.1]).

3.3.36 TEST_TABLE

VALE_ABS new:

- To test the absolute value of a result (cf [8.1.1]).

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