Organization (S): Instruction manual

EDF-R&D/AMA
U4.0- Booklet: Use of the commands
Document: U4.01.04

Innovations and modifications of version 8

Abstract:

The object of this document is to give a comprehensive view of the modifications of syntax and new opportunities of the commands of Code_Aster occurred 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** of June 2006 and valid for **version 8.4** of 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 commands and the file `histor` of corresponding subversion (e.g.: [8.3.7], section *Development* of the www.code-aster.org `site`).
The impacted commands are listed alphabetically.

1 Innovations between 8.3 and 8.4

1.1 New commands

1.1.1 MACR_SPECTRE

It acts of an ordering of computation of floor spectrums in several nodes, in postprocessing of a seismic computation. It connects the following stages (cf [8.3.21], documentation [U4.32.11]):

- recovery of the relative acceleration of the various nodes,
- combination with driving acceleration to obtain absolute acceleration,
- computation of response sprectrums for several depreciation,
- wraps three-dimensions functions corresponding to the same bottom to obtain the floor spectrum.

1.1.2 POST_GP

the object of this command is to gather the various stages of a postprocessing of which the goal is to calculate the energy criterion Gp at the conclusion of a thermomechanical computation. Either one typically identifies the breaking values of the Gp parameters according to critical tenacities data with a built-in temperature (on a computation of test-tube CT), or one estimates times of fracture on a transient starting from the breaking values of Gp previously identified (cf [8.3.14], documentation [U4.82.31]).

1.1.3 POST_K_TRANS

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

1.1.4 SIMU_POINT_MAT

Makes it possible to simply carry out quasi-static nonlinear mechanical computations on a material point. The computation is in fact carried out on a tetrahedron. One defines as starter the history of the loading, the material and behavior, and the urgent of computation (cf [8.3.11], documentation [U4.51.12]).

1.1.5 Versions of the tools

the version of the tools of refinement/coarsening of mesh homard 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 command variables (field of parameters of mechanical computation) of standard corrosion, hydration and irradiation are provided in AFFE_MATERIAU under key word AFFE_VARC since version 8.3 (cf general modifications in 8.3). Drying, the unelastic strains and the metallurgy join same logic (cf [8.3.10]).
Remain the temperature…

Key words SECH_CALCULEE and EPSA_CALCULEE thus disappear from AFFE_CHAR_MECA.

1.3 Resorptions

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

The modelization 3D_JOINT_CT was reabsorbed.

Constitutive law POLY_CFC is removed, replaced by POLYCRISTAL, is rich.
Command DEFI_TEXTURE is removed.

The standard obstacle disappears, command DEFI_OBSTACLE produced an object of the table_fonction type which one can handle with the classical operators dealing with the arrays.

1.4 Commands modified

1.4.1 Behavior of the nonlinear operators

For the constitutive laws, a similar key word, in general, is added/modified in command DEFI_MATERIAU.

Automatic cutting of time step:

- New key words 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 UNIFORME, the automatic method EXTRAPOLATES. This last tent to determine by extrapolation the number of subdivision and the ratio to apply to converge with the nombre of iterations requested.
- The commands 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 forces generalized with damage in bending. Replace GLRC present the model 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/bending for the damage but damage and plasticity are not coupled. The applications concerned are the seismic analyses of reinforced concrete structures.

New behavior VMIS_ISOT_PUIS :

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

Examination of the structural analyzes in civil engineer:

- New options were introduced into CALC_ELEM : EPVC_ELNO/ELGA whose components are the thermal strains, the shrinkage of dessication and the endogenous shrinkage.
- New options EPFP_ELNO/ELGA calculate the clean strain of creep for models BETON_UMLV and GRANGER.
- Options EPFD_ELNO/ELGA calculate the strain of creep of dessication.
- The EPGR_xxxx options are removed.

New DEFORMATION=' REAC_GEOM':

- Processing of the multifibre beams (element POU_D_TGM) into large displacements and large rotations with geometrical reactualization and an assumption of small strains without neglecting the geometrical stiffness (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 Key word SUIVI_DDL

This new key word, available under STAT_NON_LINE / DYNA_NON_LINE, makes it possible to follow during computation the value in a point or a extremum of a component of a field (cf [8.3.3).

1.4.3 Key word solver

This key word is common to operators DYNA_LINE_TRAN, DYNA_NON_LINE, MECA_STATIQUE, STAT_NON_LINE, THER_LINEAIRE, THER_NON_LINE.

New METHODE=' MUMPS'/SCALING and RENUM:

- SCALING controls the type of preprocessing to be operated with the system "to balance it". RENUM makes it possible to choose the type of renumbering (cf [8.3.1]).

1.4.4 AFFE_CARA_ELEM

COQUE/VECTEUR new:

- Allows to define the vector directing the local coordinate system of the shells by its coordinates without passing by ANGL_REP (cf [8.3.5]).

MASSIF/ANGL_EULER new:

- Allows to define the vector directing the local coordinate system of the solid elements into orthotropic by giving the Eulerian angles instead of the nautical angles (ANGL_REP) (cf [8.3.11]).

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

- Allows to carry out a sensitivity analysis compared to a term of the elementary matrix of the elements DISCRET and DISCRET_2D, restricted with the stiffness matrix and of mass (cf [8.3.13]).

1.4.5 AFFE_CHAR_MECA/AFFE_CHAR_MECA_F

NOM_CHAM, COEF_IMPO, COEF_MULT_ESCL removed:

- These key word were used to define unilateral conditions in THM in particular. It is now necessary to use key word LIAISON_UNILATER (cf [8.3.3]).

New FOND_FISSURE (contact continuous method):

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

New RACCORD_SURF (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 a LIAISON_DDL (cf [8.3.18]).

1.4.6 New

AFFE_MATERIAU AFFE_NOEUD:

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

LIST_NOM_VARC news possibilities:

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

1.4.7 AFFE_MODELE

SUPER_MAILLE replaces MESH :

- Homogenization of the vocabulary, one uses key word SUPER_MAILLE now when it is about substructuring (cf [8.3.20]).

1.4.8 CALC_ELEM

REPE_COQUE new:

- One finds under this factor key word parameters of definition of the local coordinate system of examination of the shell elements similar to those of AFFE_CARA_ELEM. Postprocessing can thus be carried out in different references by mesh groups (cf [8.3.21]).

New options ARCO_ELNO_SIGM/ARCO_NOEU_SIGM

- These options calculate the stresses of arc and cantilever useful for the examination in local coordinate system on the sides of a structure 3D. This is in particular used for the analysis of the stresses 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 stress tensor (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 default value removed:

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

1.4.11 CALC_G

NUME_FOND new:

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

New option: CALC_K_MAX

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

New method of lissage: LAGRANGE_REGU

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

Suppression of MODELE , CHAM_MATER , DEPL , QUICKLY , ACCE

- information are directly extracted from the result concept in entry of the command 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

- option R2C respectively makes it possible null to produce a complex field from a real field with imaginary part. Option C2R makes it possible to extract the real or imaginary part of a complex field (cf [8.3.12]).

COEF_C new

- For operation ASSE, makes it possible to apply a coefficient complexes with the values of a field (cf [8.3.12]).

1.4.13 New

CREA_TABLE TYPE_TABLE

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

1.4.14 DEFI_COMPOR

FAMI_SYS_GLIS , new possibility: BCC24

- Family of system of sliding specific to bainitic steels (cf [8.3.11]). The parameters H1 with H6 were introduced are DEFI_MATERIAU under ECRO_ISOT1 to define the matrix of interaction between sliding systems.

ANGL_EULER new:

- See AFFE_CARA_ELEM (cf [8.3.11]).

1.4.15 DEFI_INTERF_DYNA

DDL_ACTIF removed:

- Only option MASQUE is usable (cf [8.3.3]).

1.4.16 DEFI_MAILLAGE

SUPER_MAILLE and DEFI_SUPER_MAILLE replace MESH and DEFI_MAILLE :

- See AFFE_MODELE (cf [8.3.20]).

1.4.17 debut/new

POURSUITE SD_VERI:

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

1.4.18 DEPL_INTERNE

SUPER_MAILLE replaces MESH :

- See AFFE_MODELE (cf [8.3.20]).

1.4.19 EXEC_LOGICIEL

MAILLAGE new:

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

1.4.20 IMPR_RESU

UNITE by default with format GMSH

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

1.4.21 LIRE_IMPE_MISS/MACRO_MISS_3D

TYPE = "BINAIRE" 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]).

1.4.22 LIRE_MAILLAGE

RENOMME new:

- Allows the reading of a mesh with FORMAT=' MED' to re-elect certain names of mesh groups 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 restricted with 8 characters. (cf [8.3.22]).

1.4.23New

MACRO_MATR_ASSE CHAR_CINE:

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

1.4.24New

MACR_ADAP_MAIL SENSIBILITE:

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

1.4.25MACR_ELEM_STAT

PROJ_MESU, MODE_MESURE new:

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

1.4.26New

MACR_RECAL LIST_DERIV:

- Allows to use derivatives resulting from the sensitivity analysis ; it is possible to mix finite differences and sensitivity (cf [8.3.8]).

New METHODE/GRADIENT/FUNCTIONAL/ INTER_FONC_MAXI:

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

New DISPLAY:

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

1.4.27Removed

MODEL MODI_MAILLAGE:

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

1.4.28NORM_MODE

MASSE, RAIDE, AMOR new:

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

1.4.29New

POST_RCCM TABL_RESU_PRES:

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

SY_MAX new:

- Conventional limit of elasticity, alternative to the value SY_02 presents 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 the MODELE_2 before projection (cf [8.3.2]).

1.4.31 New

PROJ_MESU_MODAL NOM_PARA:

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

TRANSF_GEOM_2 new:

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

1.4.32 New

PROJ_SPEC_BASE TOUT_CMP:

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

1.4.33 New

PROPA_XFEM METHODE and RADIUS:

- The domaine d'application of the command is extended to 3D propagation cracks in mixed mode on unspecified or hexahedral tetrahedral meshes with face opposite parallels (cf [8.3.9]).

1.4.34 New

RECU_FONCTION THREE-DIMENSIONS FUNCTION:

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

1.4.35 REST_BASE_PHYS

GROUP_NO, NOEUD, GROUP_MA, MESH new:

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

1.4.36 TEST_RESU

VALE, VALE_I, VALE_R new behavior:

- One can validate 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 command variables corrosion, hydration and irradiation are not provided any more in AFFE_CHAR_MECA but in AFFE_MATERIAU under key word AFFE_VARC. This will make it possible to extend the number and the type of the command variables. In the long term, the temperature, drying and the unelastic strains should be melted in this mould (cf [8.1.4, 8.2.18]).

2.2 New commands

2.2.1 CALC_G

commands CALC_G_THETA_T and CALC_G_LOCAL_T were amalgamated in a single command CALC_G.

2.2.2 POST_MAIL_XFEM / POST_CHAM_XFEM

command POST_MAIL_XFEM makes it possible to generate a cracked mesh from a sane mesh and crack X-FEM. This mesh is only produced with goal of visualization and does not have to be used for a computation.
Command POST_CHAM_XFEM uses this cracked mesh and makes it possible to create a field of displacement associated with the cracked mesh. This field of displacement could be then visualized (IDEAS, GMSH…).

2.3 Resorptions

the following features were reabsorbed in version 8.3:

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

- Constitutive laws THM: ELAS_THM, SURF_ETAT_SATU, SURF_ETAT_NSAT, CAM_CLAY_THM, LIQU_SATU_GAT, LIQU_NSAT_GAT,
- Modelizations APPUI_REP and ASSE_GRIL,
- Commands POST_SIMPLIFIE, DIST_LIGN_3D, DEFI_THER_JOULE,
- Computation option INDU_MUTU.

2.4 Modified commands

2.4.1 Constitutive laws of the nonlinear operators

In general, a similar key word is added/amended in command DEFI_MATERIAU.

HOEK_BROWN modified:

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

ELAS_HYPER new:

- Constitutive law very-elastic of Signorini (Mooney-Rivlin) (cf [8.2.8]).

IRRAD3M new:

- Constitutive law of steels under irradiation (cf [8.2.9]).

DIS_GRICRA modified:

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

New DEFORMATION=' COROTATIONNEL':

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

2.4.2 AFFE_CARA_ELEM

NOEUD, MESH, GROUP_NO, GROUP_MA moved

- These key words are accessible according to whether the characteristic of the discrete elements is "_N" or "_L" (cf [8.2.16]).

2.4.3 New AFFE_CHAR_MECA/

AFFE_CHAR_MECA_F DIST_POUTRE/DIST_COQUE and CARA_ELEM:

- The taking into account during the processing of the contact of a clearance allows corresponding to the radius of the beam (section circular) or to the thickness of the shell (cf [8.2.6, 8.2.16]).

METHODE = new "GPC":

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

New LIAISON_UNILATER:

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

New VECT_ORIE_POU:

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

2.4.4 AFFE_MODELE

Modelization: C_PLAN_X, D_PLAN_X

- Modelization XFEM in stresses and plane strains (cf [8.2.1, 8.2.14]).

Modelizations: 3D_THH2MD, 3D_THH2MS...

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

2.4.5 CALC_ELEM

QIRE_EL. _SIGM, QIZ2_EL. _SIGM new options associated to the key word RESU_DUAL :

- Error indicators in quantity of interest (cf [8.2.16]).

2.4.6 CALC_G

LISSAGE = "LAGRANGE_NO_NO" new:

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

2.4.7 CALC_NO

QIRE_NOEU_ELEM new option:

- Error indicators in quantity of interest (cf [8.2.16]).

2.4.8 New

CALC_TABLE ACTION:

- This factor key word allows to apply in their order of appearance several operations (cf [8.2.11]).

REGEXP new:

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

SENSIBILITE new:

- Gives access a derived array (for example resulting from a postprocessing of derivatives of one result) (cf [8.2.16]).

2.4.9 New

CREA_CHAMP OPERATION=' NORMALE':

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

2.4.10New

CREA_TABLE SENSIBILITE:

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

2.4.11DEFI_FOND_FISS

FOND_SUP , new FOND_INF:

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

PREC_NORM new:

- The accuracy defines with which one searches the nodes belonging to the norm at the crack front. This operation was made before in POST_K1_K2_K3 (cf [8.2.20]).

2.4.12TO DESTROY

SENSIBILITE new:

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

2.4.13DYNA_LINE_HARM

- the command is now réentrante (cf [8.2.1]).

2.4.14New

DYNA_LINE_TRAN ACCE_INIT:

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

solver modified:

- Homogenization with the other commands (cf [8.2.11]).

2.4.15New

DYNA_NON_LINE ETAT_INIT/ACCE:

- 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 balance equation or not. If MODI_EQUI=' OUI', one uses a complete diagram HHT; 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 reactualized stiffness matrix (cf [8.2.11]).

MODE_VIBR new:

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

DIFF_CENT replaces NEWMARK :

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

TCHAMWA new:

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

2.4.16New

DYNA_TRAN_EXPLI ETAT_INIT/ACCE:

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

MASS_DIAG new:

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

MASS_GENE, RIGI_GENE, AMOR_GENE new under new PROJ_MODALEXCIT_GENE :

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

STOP_CFL new:

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

2.4.17DYNA_TRAN_MODAL

Definition of the nodes of shocks:

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

2.4.18New

IMPR_CO CONCEPT:

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

2.4.19 LIRE_TABLE

TYPE_TABLE removed:

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

2.4.20 MACR_LIGN_COUPE

GROUP_MA, MESH new:

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

2.4.21 MACRO_MISS_3D

New parameters:

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

2.4.22 POST_K1_K2_K3

TYPE_MAILLAGE , NB_NOEUD_COUPE new:

- Allows postprocessing on free meshes (only the structured meshes were supported before) for which one specifies the number of nodes to be built in the normal direction at the crack front (cf [8.2.20]).

2.4.23 POST_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]).

2.4.24 PROJ_CHAMP

Accepts 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 data structure and not only mode_meca with the old method using xxxx_MECA (cf [8.2.4]).

2.4.25 POST_ELEM

INTEGRALE new :

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

2.4.26 POST_RCCM

MX, MX_TUBU new :

- Allows to carry out a computation RCCM with the unit method by defining two load vector forces: for the bypass, for the pipe (cf [8.2.12]).

2.4.27New

REST_BASE_PHYS CYCLIQUE:

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

New RESU_PHYS:

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

2.4.28STAT_NON_LINE

METHODE = "FETI" new :

- Functionality under development, the scope of application is restricted (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 nombre of iterations can now be defined in a way different for each behavior from the model.
As regards syntax, key words RESI_INTE_RELA, INTER_INTE_REAL, INTER_INTE_MAXI, RESO_INTE are moved CONVERGENCE towards COMP_INCR/COMP_ELAS (of which an occurrence defines each behavior).

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

3.1.2 Solver MUMPS

a new direct solver is available in *Code_Aster*: MUMPS.
He makes it possible to solve problems known with the classical solvers when the matrix is not positive (case XFEM, incompressible elements,…).
He is usable by commands 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 is not part of the sources of Code_Aster, it acts of an external package.*

3.1.3 FETI solver

FETI solver is a parallel solver by decomposition of fields.
He is under development; its field of application is thus limited in version 8.2.

3.2 New commands

3.2.1 CALC_TABLE

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

- concatenate/to combine two arrays 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 an array,
- to order the lines.

3.2.2 INFO_FONCTION/CALC_FONCTION

command CALC_FONCTION was deeply rewritten so that it is simple and fast to introduce there new generic processing at the request of the users.
Thus, only the operations which calculate a function (or a three-dimensions function) from other functions were preserved in CALC_FONCTION.
It should be noted that the operation of lissage wraps floor spectrums (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 array) are now available in command INFO_FONCTION :

- MAX, RMS, NOCI_SEISME, NORM and ECART_TYPE.

3.2.3 LIRE_FORC_MISS/LIRE_IMPE_MISS

LIRE_IMPE_MISS and LIRE_FORC_MISS make it possible respectively to create a generalized matrix and a generalized vector of seismic force from the matrix of impedance of soil or the seismic forces of soil created by MISS3D for a frequency of extraction given.

3.2.4 POST_MAIL_XFEM/POST_CHAM_XFEM

3.2.5 MAC_MODES

This command 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 commands

3.3.1 AFFE_CARA_ELEM

CARA_SECT removed:

- Key word 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 forces (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/new METHODE=' VERIF':

- 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]).

New CONTACT/SLIDE, ALARME_JEU:

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

New CONTACT_INIT:

- This key word makes it possible to do without artificial stiffness blocking motions of rigid bodies (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 a CHAM_NO like second member of the linear relation (cf [8.0.8]).

ELIM_MULT new:

- If one wishes to bind several meshes between them (key word LIAISON_MAIL), one eliminates the redundant conditions now in order to avoid obtaining null pivots at the time of 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 condition of cyclic symmetry with phase shift (cf [8.0.8]).

Removed PRESSION_CALCULE:

- EVOL_CHAR makes 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 command variables 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

News modelizations PLAN_ELDI, PLAN_JOINT, AXIS_ELDI, AXIS_JOINT :

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

New modelizations :

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

3.3.6 Removed

CALC_ELEM DURT_ELGA_TEMP:

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

3.3.7 New

CALC_FATIGUE COEFF_PREECROU:

- This parameter makes it possible to take into account a préécrouissage 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 of the finite elements with discontinuity) from nodes groups (cf [8.0.13], [8.0.18]).

QUAD_LINE new:

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

3.3.9 CALC_FATIGUE

CRITERE = new "FATEMI_SOCIE":

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

3.3.10New

CALC_FLUI_STRU AMOR_REDUIT_CONN:

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

3.3.11CALC_G_LOCAL_T/CALC_G_THETA_T

OPTION = "K_G_MODA" new:

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

3.3.12CALC_META

META_INIT, META_ELGA_TEMP removed:

- To suppose that the families of points of integration are the same ones for metallurgical computation and mechanical computation 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` is calculated by default (cf [8.0.14]).

3.3.13CREA_CHAMP

EXTR/ARRAY new:

- Allows to create a field from data contained in `an array` (cf [8.1.17]).

3.3.14debut/POURSUITE

ERREUR new:

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

IMPR_MACRO new:

- Allows to choose the view of the commands launched by a macro-command 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 computation (closing of the base, transfer of the results) (cf [8.0.13]).

3.3.15New

DEFI_BASE_MODALE ORTHO_BASE:

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

3.3.16 DEFI_FISS_XFEM

CONTACT, INTEGRATION new:

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

RAYON_ENRI new:

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

New ALGO_LAGR:

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

3.3.17 DEFI_FLUI_STRU

CSTE_CONNORS, RHO_TUBE, NB_CONNORS new:

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

3.3.18 DEFI_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]).

3.3.19 DEFI_MATERIAU

RUPT_FRAG, RUPT_FRAG_FO new:

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

GATT_MONERIE new:

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

BETON_REGLE_PR new:

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

HOEK_BROWN new:

- Constitutive law of Hoek-Brown modified for the mechanical analysis of the rocks (cf [8.1.1]).

CABLE modification:

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

3.3.20 DYNA_NON_LINE

See STAT_NON_LINE.

3.3.21 New

EXTR_MODES SEUIL_X/_Y/_Z:

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

3.3.22New

GENE_MATR_ALEA MATR_MOYEN:

- Allows to generate a random macr_elem_dyna from a mean value (cf [8.1.8]).

3.3.23IMPR_GENE

FORMAT, UNITE moved:

- Etaient before under factor key word the GENE (cf [8.0.21]).

3.3.24IMPR_RESU

PARTIE new:

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

GROUP_MA, MESH, GROUP_NO, NOEUD new:

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

3.3.25New

LIRE_RESU POSI_AMOR:

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

3.3.26MACR_CABRI_MAIL

FICHIER removed:

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

3.3.27New

MACR_LIGN_COUPE LIGNE_COUPE/ VECT_Y:

- Allows to define a local coordinate system for postprocessing (cf [8.1.6]).

3.3.28New

MACR_RECAL GRAPHIQUE/ FORMAT:

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

3.3.29MECA_STATIQUE

NUME_COUCHE, NIVE_COUCHE, ANGLE and PLANE removed:

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

3.3.30MODI_MODELE_XFEM

CRITERE new:

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

3.3.31 New

POST_K1_K2_K3 SYME_CHAR:

- Allows to take into account the symmetry of the modelization in the computation 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 Removed

STAT_NON_LINE VARI_COMM:

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

New DISPLAY:

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

3.3.34 New

TEST_FONCTION VALE_ABS:

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

3.3.35 New

TEST_RESU RESU_GENE:

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

VALE_ABS new:

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

3.3.36 New

TEST_TABLE VALE_ABS:

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

Intentionally white left page.