Innovations and modifications of version 13

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 13, i.e. since version 12.3.24.

For more precise details, one will consult the documentation of the orders and itS fileS `histor` ofS under-versionS.

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1 Linear and non-linear dynamics

1.1 Operator DYNA_VIBRA

The recasting of the operator DYNA_VIBRA place gave to the following evolutions:

- Reprogramming of the diagram of integration DEVOGE and generalization with all calculations.
- Availability of the diagram of integration ITMI for any transitory calculation and not only YEWS.
- Introduction of a new method for the treatment of the shocks while taking as a starting point the characteristics by the YEWS, with the keyword TRAITEMENT_NONL = 'CLARIFIES'/'IMPLICIT'.
- Evolution of filing to allow the user to force the calculation and the filing of the moments of interest.
- Treatment of the localised non-linear efforts (options TRAN/GENE).
- Introduction of one-way friction for the law DIS_CHOC via the keyword UNIDIRECTIONNEL=/'YES'/'NOT'.

1.2 Coupling MISS3D

- Improvement of CALC_MISS/DEFI_SOL_MISS with the more pushed automation of the generation of data MISS3D
- Improvements of DEFI_SOL_EQUI of which it introduction of a loading ONDE_PLANE several types with or without boundary conditions of periodicity
- Modification of CALC_MISS/IMPEDANCE_TEMPORELLE for the exit of a binary file

1.3 Tools

Dynamic analysis on modal basis:

- Checking of the physical direction of the damping calculated by the macro-order CALC_AMOR_MODAL

Postprocessings of the signals:

- Calculation of functions of coherences starting from temporal signals via CALC_FONCTION/COHERENCE
- Interpolation of accélérogrammes via CALC_FONCTION/INTERPOL_FFT
- Introduction of the macro-order CALC_SPECTRE_IPM for the modeling of the interaction floor-material
- Introduction of the macro-order LISS_SPECTRE to automate smoothings of spectra.

2 Thermo-hydro-mechanics

2.1 Modelings

Modeling membranes, plates and hulls:

- Introduction of a modeling of membrane in great transformations
- Improvement of the element DKT with the taking into account of the third rotation in the elements of plates
- Refactoring of the elements SHB

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2.2 Loadings

Improvements:

- Taking into account of great displacements in the solid connections AFFE_CHAR_MECA/LIAISON_SOLIDE
- Taking into account of the wave reflected in the loading plane wave AFFE_CHAR_MECA_F/ONDE_PLANE/DIST_REFLECHI

2.3 Laws of behavior

- Improvement of the law ENDO_FISS_EXP with the modeling of refermetures of cracks.
- Introduction law of Iwan for modeling of the cyclic behavior of the grounds
- Introduction of a model of Rankine for the modeling of the behavior of the joinrs.
- Introduction of the law LKR (improvement of LETK by modifications of the functions of work hardening and introduction of thermics) for thermo-élasto modeling (- visco) - plastic applicable to the rocks and the ground (dilating materials).
- Modification of the law of behavior GRAN_IRRA_LOG for modelings of the guide tubes.

2.4 Postprocessings

Postprocessings trades:

- Introduction of the macro-order POST_LIQUEFACTION for the postprocessing of Critère of detection of liquefaction of the ground.
- Evolutions of the operator POST_RCCM.

Visualizations :

- Addition of features for the visualization of the efforts généraliséS of the elements of structures in the form of diagrams on grid.
- Addition of features for the visualization of the parameters of ELAS_FO .

3 Breaking process

Elements X-FEM:

- Optimization of cutting under elements in the quadratic case for elements X-FEM.
- Introduction of the multipliers of Lagrange forS modelS hydro-mechanical X-FEM.

4 Digital methods

4.1 Reduction of model (ROMANIAN)

- Introduction of the ROMANIAN (*Reduced Order Model*)
- Introduction of the operator of postprocessing for the ROMANIAN: REST_REDUIT_COMPLET
- Application of the reduction of model into vibroacoustic

4.2 Contact

New method of contact:

- Introduction of the method LAKE and improvement of pairing segment-segment;

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- Parallelisation of the “loop” on the meshs slaves.

5 Architecture, ergonomics, performances

5.1 Ergonomics

Simplified programming
- Factorization of the catalogues of finite elements
- Improvement of performance of reading of the grid to the format *.med

Simplification of postprocessings:
- Naming of the internal variables according to the mechanical terminology

Suppression:
- Removal of the order DEFI_PARTITION
- Suppression of the impression to the format CASTEM
- Removal of the direct access to the keywords NODE and MESH

5.2 Performances

Rise of version for the tools:
- Version MUMPS 5.1
- Version of the MONGREL renumerotor: from the 4.0 (seven 1998) to the 5.1.0 (March 2013).
- Version of PETSc (3.7.3)
- Version MED 3.2.1

Addition of new features related toX solvorS MUMPS and PETSc :
- Introduction of a new value of the keyword SOLVEUR/POSTTRAITEMENTS=' MINI'
- Introduction of the LowRank method via new the keyword SOLVEUR/LOW_RANK_TAILLE and SOLVEUR/LOW_RANK_SEUIL.
- Automatic activation of the threads
- Parallel phase of analysis in MUMPS
- Preconditionnor of second-level LMP.

Improvement of parallelism:
- Authorization of the parallelism of elementary calculations for the macronutrients
- Introduction of one hybrid mode of distribution for elementary calculations (SOUS_DOMAINE)

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