Structure of data sd_solvor

Summary:

This document describes the structure of data sd_solvor. This one defines the method of resolution of the linear systems as well as the parameters contiguous to the selected solvor.

Contents

1 General information

This object of the type SOLVEUR has as a function to store and convey between the various routines of the code (in-house of an order or between orders), the related information with the parameter settings of the linear solveurs. In particular, it defines the method of resolution of the linear systems mono-field (LDLT, MULT_FRONT, PETSC, MUMPS or GCPC). This object is created on the volatile basis (the most frequent case) or on the total basis (burst orders).

Generally, it is created and filled *via* CRESOL/CRSV ** (the first two letters of the solvor: DRIVEN for MUMPS direct solvor and CRSMSP for MUMPS pre-conditioner, EP for PETSC, LD for LDLT, GC for GCPC and MF for MULT_FRONT).
To answer some typical cases, other dedicated routines create and fill one SD_SOLVEUR : CRSOLV [1], OP0014 [2] and CRSINT [3]. One tries to limit the number and to privilege the use of the principal routine of it: CRESOL.
Whatever the routine which creates the objects of the structure of data SOLVEUR , dimensioning is done exclusively in a routine hat: SDSOLV .

During a modification of this structure of data it is thus necessary to take care of:
- *to put in coherence, if necessary, sources mentioned above,*
- *to update, if necessary, the catalogue sd_solveur.py ,*
- *to update documentations (this Doc. D and if necessary Doc. U4.50.01),*
- *to enrich or modify, if necessary, some CAS-tests.*

2 Tree structure

```
SOLVEUR (K19)    :: =record
  ♦     '.SLVK'    :    OJB    S V K24   long=14  (initialized with 'XXXX')
  ♦     '.SLVR'    :    OJB    S V R     long=4   (initialized with 0.d0)
  ♦     '.SLVI'    :    OJB    S V I     long=8   (initialized with -9999)
```

3 Contents of the basic objects

3.1 Case LDLT or MULT_FRONT

SLVK:
- SLVK (1) : method of resolution ('LDLT' or 'MULT_FRONT'),
- SLVK (2) : unutilised,
- SLVK (3) : unutilised,
- SLVK (4) : method of renumerotation (keyword RENUM). The possible values are:
  'RCMK' or 'WITHOUT' (if LDLT)
  'MANDELEVIUM' or 'MDA' or 'MONGREL' (if MULT_FRONT),
- SLVK (5) with SLVK (12): unutilised.
- SLVK (13) : elimination of the equations of Lagrange (ELIM_LAGR=' OUI'/'NOT').
- SVLK (14): activation of pre-conditioner XFEM ('YES'/'NOT'). The value by default is 'NOT'. This site interacts with the order MODI_MODELE_XFEM ; if PRETRAITEMENT=' SANS', then the site takes the value 'NOT'; if PRETRAITEMENT=' AUTO', then the site can take the value 'YES'.

SLVR:

1 For CALC_CORR_SSD, MODE_STATIQUE, NUME_DDL_GENE, NUME_DDL, MACR_ELEM_STAT.
2 For TO FACTORIZE.
3 For a call in writing pad of MUMPS in MODE_STATIQUE and CALC_CORR_SSD.

SLVR (1) : unutilised,
SLVR (2) : unutilised,
SLVR (3) : size block (if LDLT)
it is the size of the blocks of the object .UALF of an online storage of sky,
SLVR (4) : unutilised.

SLVI:
SLVI (1) : value of NPREC,
SLVI (2) : unutilised,
SLVI (3) : istop
Behavior wanted in the event of singularity during factorization
0 : error <F> in the event of singularity or of quasi-singularity
1 : error <F> in the event of singularity
alarm <A> in the event of quasi-singularity
2 : No message in the event of singularity or of quasi-singularity
SLVI (4) with SLVI (8) : unutilised.

3.2 Case GCPC

SLVK:
SLVK (1) : method of resolution 'GCPC',
SLVK (2) : pre-packaging of the matrix of work
(PRECOND=' LDLT_INC', 'LDLT_SP' or 'WITHOUT'),
SLVK (3) : name of SD solvor Mumps in the case PRECOND=' LDLT_SP',
SLVK (4) : value of RENUM ('RCMK' or 'WITHOUT'),
SLVK (5) with SLVK (12): unutilised.
SLVK (13) : elimination of the equations of Lagrange (ELIM_LAGR=' OUI'/'NOT').
SLVK (14) : unutilised.

SLVR:
SLVR (1) : value of RESI_RELA (copy for NEWTON_KRYLOV),
SLVR (2) : value of RESI_RELA,
SLVR (3) with SLVR (4): unutilised.

SLVI:
SLVI (1) : unutilised,
SLVI (2) : value of NMAX_ITER,
SLVI (3) : unutilised,
SLVI (4) : value of NIVE_REMPLISSAGE,
SLVI (5) : iteration count to reach convergence in the case PRECOND=' LDLT_SP',
SLVI (6) : value of REAC_PRECOND in the case PRECOND=' LDLT_SP',
SLVI (7) : value of PCENT_PIVOT in the case PRECOND=' LDLT_SP',
SLVI (8) : istop
Behavior desired in the event of error at the time of the iterative linear resolution
0 : error <F> in the event of failure
2 : no message in the event of failure, code return not no one

3.3 Case PETSc

SLVK:
SLVK (1) : method of resolution 'PETSC',
SLVK (2) : pre-packaging of the matrix of work
(PRECOND=' LDLT_INC', 'LDLT_SP', 'JACOBI', 'SOR', 'ML', 'BOOMER', 'GAMG', 'WITHOUT'),
SLVK (3) : name of SD solvor Mumps in the case PRECOND=' LDLT_SP',
SLVK (4) : value of RENUM ('RCMK' or 'WITHOUT'),

SLVK (5) : unutilised,
SLVK (6) : name of the iterative method used
('CG', 'CR', 'GMRES', 'GCR'),
SLVK (7) with SLVK (9): unutilised.
SLVK (10) : unutilised
SLVK (11) with SLVK (12): unutilised.
SLVK (13) : elimination of the equations of Lagrange (ELIM_LAGR=' OUI'/'NOT').
SLVK (14) : unutilised.

SLVR:
SLVR (1) : value of RESI_RELA (copy for NEWTON_KRYLOV),
SLVR (2) : value of RESI_RELA,
SLVR (3) : value of FILLING,
SLVR (4) : value of RESI_RELA_PC (hidden keyword).

SLVI:
SLVI (1) : unutilised,
SLVI (2) : value of NMAX_ITER,
SLVI (3) : unutilised,
SLVI (4) : value of NIVE_REMPLISSAGE,
SLVI (5) : iteration count to reach convergence in the case PRECOND=' LDLT_SP',
SLVI (6) : value of REAC_PRECOND in the case PRECOND=' LDLT_SP',
SLVI (7) : value of PCENT_PIVOT in the case PRECOND=' LDLT_SP',
SLVI (8) : istop
Behavior desired in the event of error at the time of the iterative linear resolution
0 : error <F> in the event of failure
2 : no message in the event of failure, code return not no one

3.4 Case MUMPS

SLVK:
SLVK (1) : method of resolution ('MUMPS'),
SLVK (2) : pretreatments (PRETRAITEMENTS=' AUTO' or 'WITHOUT'),
SLVK (3) : algorithm of resolution wished (TYPE_RESOL=)
'NONSYM' : not-symmetrical matrix (factorization LU)
'SYMGEN' : symmetrical matrix "general"
'SYMDEF' : symmetrical matrix "definite positive"
'CAR' : automatic choice made within sight of the characteristics of the matrix
SLVK (4) : desired renumerotor (RENUM=' AUTO', 'AMD', 'MFA', 'QAMD', 'PORD', 'PTSCOTCH' /SCOTCH' or 'MONGREL' 'PARMETIS'/),
SLVK (5) : type of activated acceleration (ACCELERATION= 'CAR','FR','FR+','LR'or'FR+'),
SLVK (6) : "virtual" elimination of the 2nd family of Lagrange when the matrix is transmitted Aster with MUMPS (ELIM_LAGR=' LAGR2'),
SLVK (7) : mixed precision (MIXER_PRECISION=' OUI'/'NOT'),
SLVK (8) : use as a preconditionnor single precision for GCPC ('YES'/'NOT'),
SLVK (9) : management of the memory allocated by MUMPS
(GESTION_MEMOIRE=' IN_CORE'/'OUT_OF_CORE'/'CAR'/'EVAL'),
SLVK (10) : unutilised
SVLK (11) : management of postprocessings (POSTTRAITEMENTS=' SANS', 'CAR', 'FORCE'),
SVLK (12) : number of version of MUMPS (for example: '5.1.0'). It is about a number licit version, i.e. tested and approved by the version of *Code_Aster* considered. In the contrary case one stops in ERREUR_F before the filling of this field. Value just filled after initialization of occurrence MUMPS only *via* routines amump*/mumpu. F.

SLVK (13) : elimination of the equations of Lagrange (ELIM_LAGR=' OUI'/'NOT'/'LAGR2' except if modal calculation, then ELIM_LAGR=' NON'/'LAGR2').
SVLK (14) : activation of pre-conditioner XFEM ('YES'/'NOT'). The value by default is 'NOT'. This site interacts with the order MODI_MODELE_XFEM; if PRETRAITEMENT=' SANS', then the site takes the value 'NOT'; if PRETRAITEMENT=' AUTO', then the site can take the value 'YES'.

SLVR:
SLVR (1) : value of FILTRAGE_MATRICE,
SLVR (2) : value of RESI_RELA (calculation and quality control of the solution, release of postprocessings according to the value of POSTTRAITEMENTS),
SLVR (3) : unutilised.
SLVR (4) : compression ratio 'low-rank' (keyword LOW_RANK_SEUIL).

SLVI:
SLVI (1) : value of NPREC (like LDLT and MULT_FRONT),
SLVI (2) : percentage of additional memory necessary to the swivellings late (value of PCENT_PIVOT)
SLVI (3) : value of ISTOP (like LDLT and MULT_FRONT),
SLVI (4) : indicator to say to MUMPS not to store the terms of its factorized (interesting if for example, one has right need for a total result standard calculation for determinant or criterion of Sturm). If it is worth 1, one does not store this not factorized (large profit report), if not one keeps it according to the standard mode.
This functionality is activated only from MUMPS 4.10.0 (for the versions in on this side one does nothing and one transmits a message UTMESS_I (if INF0=2). Temporary value (one gives, if necessary, after use its value initial) filled in the routines vpstur.f and apchar.f .
SLVI (5) : indicator to say to MUMPS to calculate in more the determinant of the matrix. If it is worth 1, it is calculated and one stores it in the temporary object ' &&AMUMP.DETERMINANT '(cf. amumpu. F), if not it is not calculated.
This functionality is activated only from MUMPS 4.10.0 (for the versions in on this side one stops in ERREUR_F . Temporary value (one gives, if necessary, after use its value initial) filled in the routines vpstur.f and apchar.f .
SLVI (6) : indicator to say to MUMPS the number of factorized matrices which one will build at the same time. This parameter is taken into account only for the options GESTION_MEMOIRE=' AUTO' and 'EVAL'. It is initialized to 1 by default. Just after its reading it there is a stop in ASSERT if this figure is illicit (<1 or >nmxins).
It is responsibility for the programmer to modify this figure when it knows that it several will have factorized to manage into simultaneous. If that is not done, management memory will be sub-optimal and calculation slows down (' CAR ') or the displayed figures will be undervalued (' EVAL ').
This case, for example, was taken into account in STAT_NON_LINE + ' CRIT_STAB '.
RQ : It is supposed that the factorized simultaneous ones require same space and one do not manage precedences (on 2 matrices, to the first one devotes half of space available, at the second, one makes in the same way, whereas one could all give him).

SLVI (7) with SLVI (8) : unutilised.