

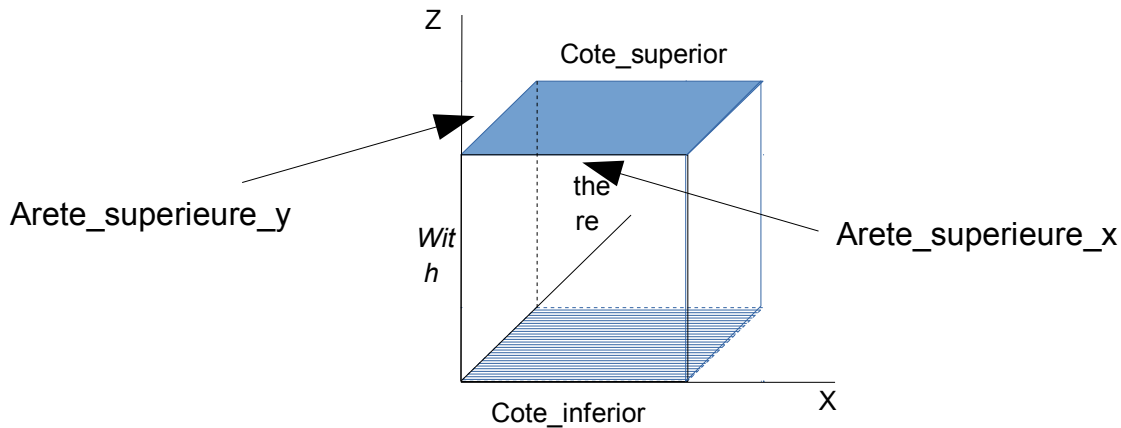
PETSC02 - Validation of PETSc with the distribution of the assembled matrix

Summary:

This CAS-test makes it possible to validate the operation of the solver PETSC with the distribution of the assembled matrix. It comprises three modelings. Among them, three relate to the elimination of the boundary conditions (AFFE_CHAR_CINE) and validate the use of the pre-conditioners multigrilles ML, BOOMER and GAMG. Modeling C rests in more on the dualisation of the boundary conditions (AFFE_CHAR_MECA) and is used for the validation of the pre-conditioner LDLT_SP. Modeling D applies a loading of Neumann (pressure). In addition, each modeling validates all the modes of distribution of elementary calculations (by groups of elements, by mesh).

1 Problem of reference

1.1 Geometry



The cube considered is of size $1\text{m} \times 1\text{m} \times 1\text{m}$.

The point A has as coordinates: $(0, 0, 0,5)$

1.2 Properties of material

- $E = 1,0 \cdot 10^{11} \text{ N/m}^2$
- $\nu = 0,3$

2 Boundary conditions and loadings

- Embedding of the base of the cube:
Lower side: $DX = 0$, $DY = 0$ and $DZ = 0$,
- To the higher side, two types of loading are applied:
 1. Displacement imposed (modelings A, B, C)
Higher side: $DZ = 1$
 2. Imposed pressure (modeling D)
Higher side: $PRES = 10^8$

3 Reference solution

3.1 Method of calculating used for the reference solution

The reference solution is of standard not-regression.

3.2 Size and result of reference

The reference variables used are:

- following average displacement z on the group of meshes `Cote_superior`
- following average displacement x on the group of meshes `Arete_superieure_y`
- following average displacement y on the group of meshes `Arete_superieure_x`
- Déplacement according to z at the point A .

4 Modeling A

4.1 Characteristics of modeling

Modeling 3D :

Many nodes: 27
Many meshes: 8 HEXA8

Modeling A uses `AFFE_CHAR_CINE`, the solver `GCR` and the pre-conditioner `BOOMER`. Each distribution of elementary calculations is tested (by groups of elements, mesh and under-fields).

5 Modeling B

5.1 Characteristics of modeling

Modeling 3D :

Many nodes: 27
Many meshes: 8 HEXA8

Modeling B uses `AFFE_CHAR_CINE` and `AFFE_CHAR_MECA`, the solver `GMRES` and the pre-conditioner `LDLT_SP`. Each distribution of elementary calculations is tested.

6 Modeling C

6.1 Characteristics of modeling

Modeling 3D :

Many nodes: 27
Many meshes: 8 HEXA8

Modeling C uses `AFFE_CHAR_CINE`, the solver `GCR` and the pre-conditioner `M1`. Each distribution of elementary calculations is tested.

7 Modeling D

7.1 Characteristics of modeling

Modeling 3D :

Many nodes: 27
Many meshes: 8 HEXA8

Modeling D uses `AFFE_CHAR_MECA`, the solver `GCR` and the pre-conditioner `LDLT_SP`. One uses the distribution by group of elements of elementary calculations. One carries out a resolution with `MECA_STATIQUE` (by applying a pressure) then a resolution with `STAT_NON_LINE` (by applying a following pressure). The second resolution makes it possible to validate the good performance of the matrix distributed for a not-symmetrical matrix.

8 Modeling E

8.1 Characteristics of modeling

Modeling 3D :

Many nodes: 27
Many meshes: 8 HEXA8

Modeling E uses `AFFE_CHAR_CINE`, the solver `GCR` and the pre-conditioner `GAMG`. Each distribution of elementary calculations is tested.

9 Summary of the results

This CAS-test shows the good performance of the solver `PETSC` with the distribution of the assembled matrix, whatever the elementary distribution, boundary conditions and préconditionneurs used.