PERF015 - Benchmark for the scalability of elementary calculations

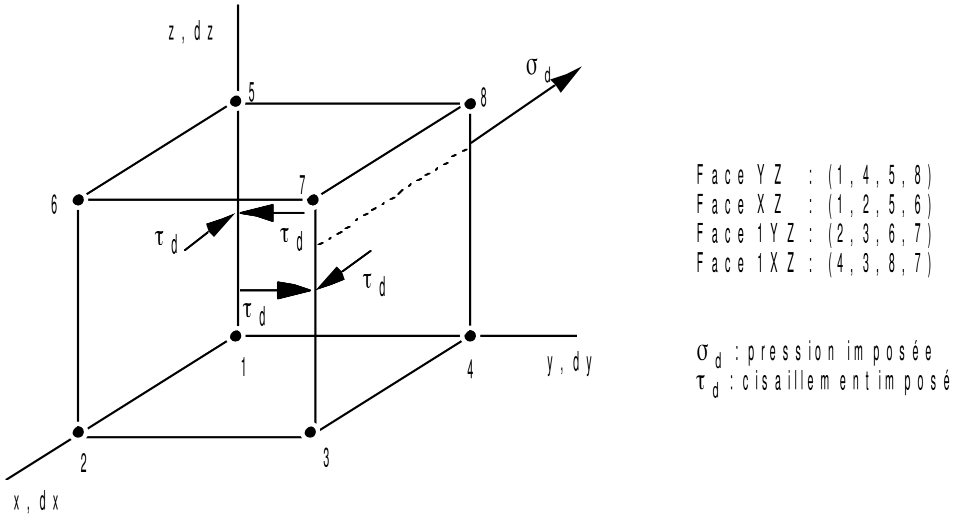
Summary:

The solved problem is a nonlinear quasi-static problem of mechanics of the structures in transient. This test shows the performances of the operator STAT_NON_LINE in parallel. The characteristic of this test lies in the fact that the essence of time CPU passed in elementary calculations.

Only one modeling is put in work. It tests the behavior VISCOCHAB with an implicit integration and constant coefficients of material, with a coherent tangent matrix with each iteration. This modeling is declined on numbers different of processors (1, 2.4 and 8).

1 Problem of reference

1.1 Geometry



1.2 Material properties

Isotropic elasticity $E=145\,000\,MPa$ $\nu=0.3$
Model viscoplasticity VISCOCHAB

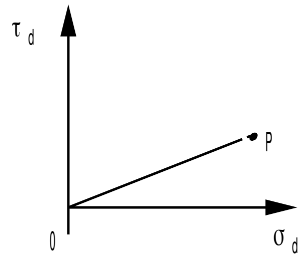
K	$35\,MPa$	B	12	ETA	0.04	C2	$65000\,MPa$
A_K	$1.$	M_R	2	C1	$1950\,MPa$	M_2	4
A_R	0.65	G_R	2.10^{-7}	M_1	4	D2	$0.552\,10^{-}1$
K_0	$70\,MPa\,S^{1/N}$	DRIVEN	19	D1	$0.397\,10^{-3}$	G_X2	$1.10^{-12}\,Mpa\,m^{-1}\,S^{-1}$
NR	24	Q_M	460	G_X1	$2.10^{-13}\,Mpa\,m^{-1}\,S^{-1}$	G2_0	$1300\,MPa$
ALP	$0\,MPa$	Q_0	$40\,MPa$	G1_0	$50\,MPa$	A_I	0.5
		QR_0	$200\,MPa$				

1.3 Boundary conditions and loadings

$N6$	$dx=dy=dz=0$	Face	XZ : $FX=-\tau_d/4$
$N7$	$dx=dy=0$	Face	YZ : $FY=-\tau_d/4$, $FX=-\sigma_d/4$
$N2$, $N3$	$dy=0$	Face	$1XZ$: $FX=\tau_d/4$
$N2$, $N3$, $N6$, $N7$	$dx=0$	Face	$1YZ$: $FY=\tau_d/4$, $FZ=\sigma_d/4$

1.4 Initial conditions

Worthless constraints and deformations with $t=0$.



$\sigma_d(t)$ and $\tau_d(t)$ linear, the point P being reached in $10\,s$ with $sigma_d(10)=150\,MPa$ and $\tau_d(10)=60\,MPa$.

2 Reference solution

2.1 Method of calculating

The value tested corresponds to the value of the stress field by elements (component σ_{xx}) at the noted point 1 on the preceding diagram. Calculation is carried out only until $t=0,5\,s$.

2.2 Result of reference

Not 1 : $\sigma_{xx}=162,10859551785\,MPa$

2.3 Uncertainty

Digital solution (not regression).

3 Modeling A

3.1 Characteristics of modeling

Machine	Version	Memory (Mo)		Number DDL	Time execution (STAT_NON_LINE) (dryness)			
		Allocated	Used		TO USE	SYSTEM	TO USE +SYS	ELAPSED
Aster4	11.2.19	400	206.56	431	1 356.8	11.6	1368.4	1368.4

4 Modeling B

Machine	Version	Memory (Mo)		Number DDL	Time execution (STAT_NON_LINE) (dryness)			
		Allocated	Used		TO USE	SYSTEM	TO USE +SYS	ELAPSED
Aster4	11.2.19	400	311	431	672.6	11.0	683.7	695.0

5 Modeling C

Machine	Version	Memory (Mo)		Number DDL	Time execution (STAT_NON_LINE) (dryness)			
		Allocated	Used		TO USE	SYSTEM	TO USE +SYS	ELAPSED
Aster4	11.2.19	400	320.46	431	363	6.53	369.5	373.1

6 Modeling D

Machine	Version	Memory (Mo)		Number DDL	Time execution (STAT_NON_LINE) (dryness)			
		Allocated	Used		TO USE	SYSTEM	TO USE +SYS	ELAPSED
Aster4	11.2.19	400	323.36	431	182.4	14.0	196.5	208.5