PERF015 - Benchmark for the scalability of elementary computations

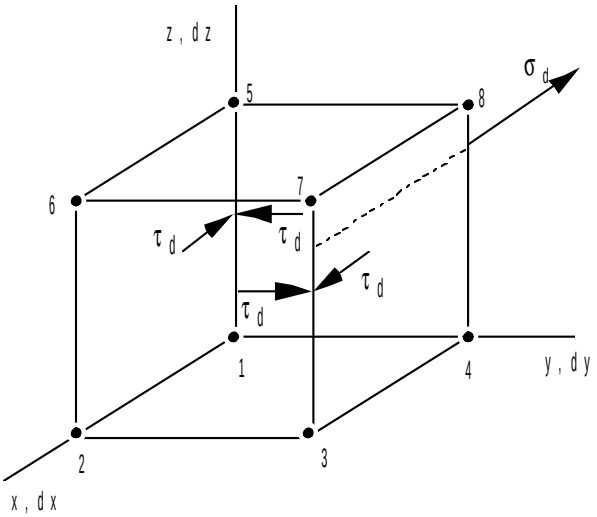
Summarized:

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

Only one modelization is put in work. It tests behavior VISCOCHAB with an implicit integration and constant coefficients of the material, with a coherent tangent matrix with each iteration. This modelization is declined on numbers different of processors (1, 2,4 and 8).

1 Problem of reference

1.1 Geometry



Face YZ : (1, 4, 5, 8)
Face XZ : (1, 2, 5, 6)
Face 1YZ : (2, 3, 6, 7)
Face 1XZ : (4, 3, 8, 7)

σ_d : pression imposée
τ_d : cisaillement imposé

1.2 Material properties

isotropic Elasticity $E = 145\,000\ MPa \quad \nu = 0.3$
model Viscoplasticity VISCOCHAB

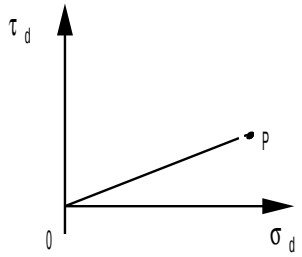
K	$35\ MPa$	B	12	ETA	0.04	C2	$65000\ MPa$
A_K	1.	M_R	2	C1	$1950\ MPa$	M_2	4
A_R	0.65	G_R	2.10^{-7}	M_1	4	D2	$0.552\,10^{-}1$
K_0	$70\ MPa\,S^{1/N}$	MU	19	D1	$0.397\,10^{-3}$	G_X2	1.10^{-12} $Mpa\,m^{-1}\,S^{-1}$
N	24	Q_M	460	G_X1	2.10^{-13} $Mpa\,m^{-1}\,S^{-1}$	G2_0	$1300\ MPa$
ALP	$0\ MPa$	Q_0	$40\ MPa$	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 : $FY = -\tau_d/4 \quad FX = -\sigma_d/4$
$N2$, $N3$	$dy = 0$	Face $1XZ$: $FX = \tau_d/4$
$N2 \quad N3 \quad N6$, $N7$	$dx = 0$	Face $1YZ$: $FY = \tau_d/4$, $FZ = \sigma_d/4$

1.4 Forced

Initial conditions and null strains 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 point noted 1 on the preceding diagram. The computation is carried out only until $t=0,5\,s$.

2.2 Result of reference

Point: 1 $\sigma_{xx}=162,10859551785\,MPa$

2.3 numerical

Uncertainty Solution (non regression).

3 Modelization A

3.1 Characteristic of the modelization

Machine	Version	(Mo) Memory		Number DDL	Time execution (STAT_NON_LINE) (dry)			
		Allocated	Used		USER	SYSTEM	USER+SYS	ELAPSED
Aster4	11.2.19	400	206,56	431	1 356,8	11,6	1368,4	1368,4

4 Modelization B

Machine	Version	(Mo) Memory		Number DDL	Time execution (STAT_NON_LINE) (dry)			
		Allocated	Used		USER	SYSTEM	USER+SYS	ELAPSED
Aster4	11.2.19	400.31 1.431			672,6	11,0	683,7	695,0

5 Modelization C

Machine	Version	(Mo) Memory		Number DDL	Time execution (STAT_NON_LINE) (dry)			
		Allocated	Used		USER	SYSTEM	USER+SYS	ELAPSED
Aster4	11.2.19	400	320,46	431.363		6,53	369,5	373,1

6 Modelization D

Machine	Version	(Mo) Memory		Number DDL	Time execution (STAT_NON_LINE) (dry)			
		Allocated	Used		USER	SYSTEM	USER+SYS	ELAPSED
Aster4	11.2.19	400	323,36	431	182,4	14,0	196,5	208,5