PERFE01 – Non regression of the homogenized computation of type BZ of Summarized platform

PERFECT:

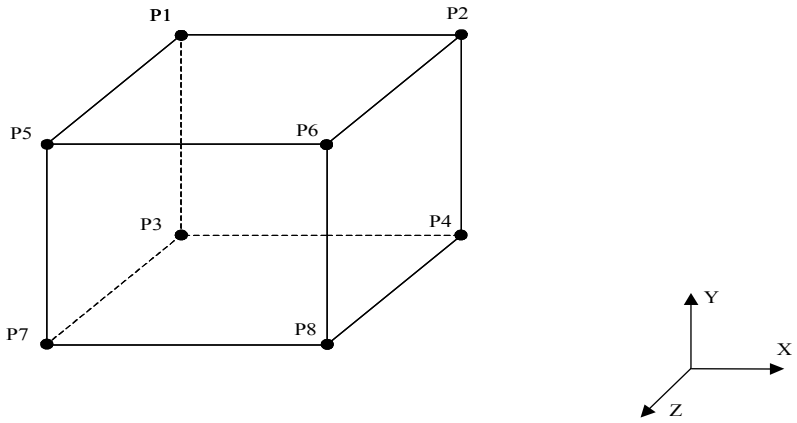
This test makes it possible to BZ validate the commands used by the modulus of platform PERFECT.
Perfect makes it possible to simulate the effects of irradiation on the components of engines.
One is interested here in steel of tank.

One considers a volume element to which one applies an imposed strain. The material consists of a polycrystal with 30 single-crystal phases, homogenized by the method Berveiller-Zaoui (BZ).

The modelization A tests the stresses and average strains obtained for a strain imposed of $2\,\%$.

1 Problem of reference

1.1 Geometry



One defines a hexahedral volume element on side 1.

1.2 Material properties

Behavior elastic with: Young modulus : $E = 210\,000 MPa$
Poisson's ratio: $\nu = 0.3$

Behavior single-crystal, with system of sliding BCC24.

The behavior of the monocrystal is defined by:

Type of flow: **MONO_VISC1** whose parameters are:
$c = 0, n = 12, K = 15 MPa$
Isotropic type of hardening: **MONO_ISOT1** whose parameters are:
$R_0 = 175.MPa$
$b = 30.$
$Q = 20.MPa$
$h = 1$ (interaction between sliding systems)

No kinematic hardening: **MONO_CINE1** $d = 0.$

Behavior POLYCRISTAL homogenized (method BZ) with 30 phases, whose directions are laid by:

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LOCALIZATION=' BZ',);
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1.3 Boundary conditions and loadings

- Face $z=0$: $DZ=0$
- Face $y=0$: $DY=0$
- Face $x=0$: $DX=0$
- Face $z=1$: $DZ=f(t)$

The loading $f(t)$ is increasing linearly of 0 for $t=0$ with 0.1 pour $\mathrm{t}=100\mathrm{s}$ decreasing the computing time, this one is led until $t=20s$, that is to say a strain imposed of $2\ \%$, in 2000 increments.

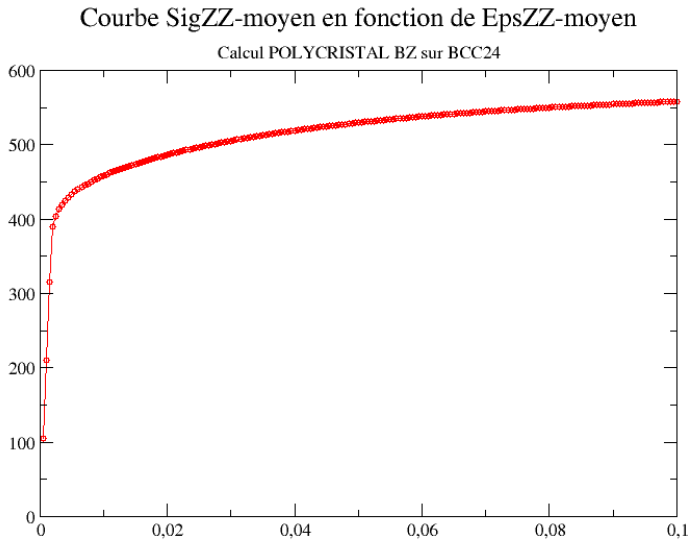
2 Reference solution

2.1 Method of calculating

the goal of this test is to check the validity of the command file used in PERFECT. The tests are thus of NON-regression.

The values tested are the average constraints and average strains following Z at time 20.

Note: by continuing computation until $t=100\mathrm{s}$, one obtains following curve of tension:



This computation takes approximately $800\,s$ TEMPS CPU.

In this case , one limits oneself to $t=20s$, which represents a TEMPS CPU of approximately $200\ \mathrm{s}$, sufficient to validate the features used.

3 Modelization A

3.1 Characteristic of the mesh

Many nodes: 8.
Modelization 3D : 1 quadratic volume element: HEXA8.

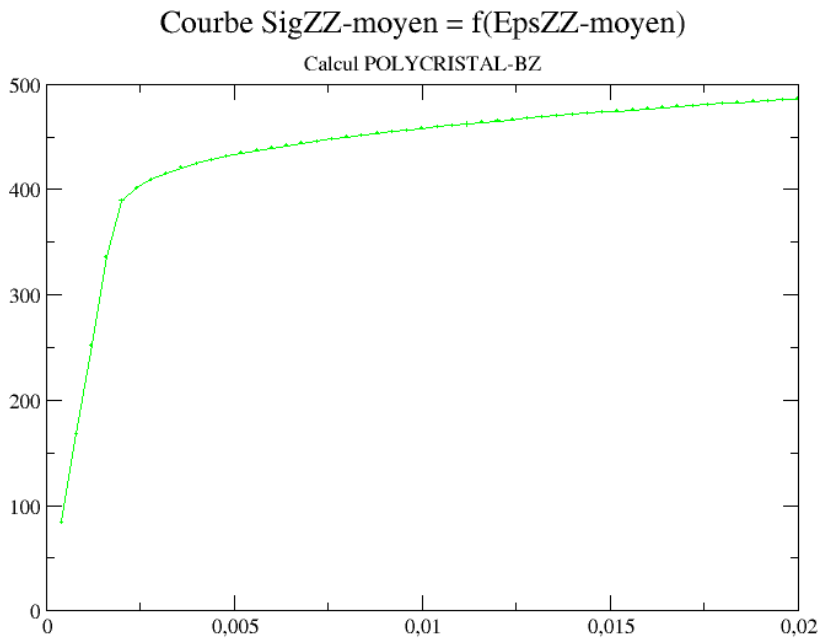
This computation uses an explicit integration (RUNGE_KUTTA), this is why one chooses time step small, and a rather coarse local convergence criterion (RESI_INTE_RELA=1.E-2). This is without influence on result, because time step is very small, and allows to optimize time computation.

3.2 Quantities tested and Results

results at time $20\,s$

Identification	Reference	*Aster*	% difference
σ_{zz} layer	-	486.333	Non regression
ε_{zz} layer	-	the 0.0176	Non regression

curve representing the evolution of the average constraint following Z according to the average strain according to Z takes the following form:



4 Summary of the results

No particular comment, tests carried out being of non regression.