SSND113 - SIMU_POINT_MAT in great deformations, gradient of transformation imposed

Summary:

One compares, on a problem reduced to the material point, for a behavior VISC_ISOT_TRAC in great deformations of the type SIMO_MIEHE, the solution obtained by imposing a tensor of deformation with that obtained by imposing the gradient of transformation which corresponds. This test makes it possible to validate this functionality in SIMU_POINT_MAT.

Modeling a: this modeling is used as reference, deformations imposed with SIMU_POINT_MAT.

Modeling b: this modeling uses a gradient of transformation imposed with SIMU_POINT_MAT.
1 Problem of reference

1.1 Geometry

It is about a material point, representative of a stress and strain state homogeneous.

1.2 Properties of material

They result from test SSNL129 [V6.02.129]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young modulus: $E$</td>
<td>215000 MPa</td>
</tr>
<tr>
<td>Poisson's ratio: $\nu$</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Traction diagram (mod. With, B and C)

\[
\begin{align*}
\text{Courbe de traction} \\
\text{déformation} & \quad \text{contrainte (MPa)} \\
0 & \quad 400 \\
0.2 & \quad 500 \\
0.4 & \quad 600 \\
0.6 & \quad 700 \\
0.8 & \quad 800 \\
1 & \quad 900 \\
& \quad 1000 \\
& \quad 1100
\end{align*}
\]

Coefficients for the viscous law $\sigma_0 = 6176$ MPa

\[
\begin{align*}
\varepsilon_0 &= 3.31131121483 \times 10^{13} \\
\varepsilon_{yy} &= 0.2 \\
T &= 2000 s
\end{align*}
\]

$\varepsilon_{yy}$ for $T = 2000 s$, in 100 increments.

1.3 Boundary conditions and loadings

The loading is in deformations imposed along the axis $y$, corresponding to speeds $\dot{\varepsilon}$ of $10^{-3} s^{-1}$

$\varepsilon_{yy} = 0.2$ for $T = 2000 s$, in 100 increments.

All the other components of the deformation are worthless.

1.4 Initial conditions

Worthless constraints and deformations with $t = 0$.

2 Results of reference

Intercomparison enters two modelings A, and B, the behavior $\text{VISC\_ISOT\_TRAC}$ in great deformations being validated in addition (SSNL129 for example).
3 Modeling A

3.1 Characteristics of modeling

Tensor deformation imposed on the material point, via the order `SIMU_POINT_MAT`.

\[ \epsilon_{yy} = 0.2 \frac{t}{2000}, \text{ in 100 increments.} \]

\[ \epsilon_{xx} = \epsilon_{zz} = 0, \quad \epsilon_{xy} = \epsilon_{xz} = \epsilon_{yz} = 0 \]

3.2 Sizes tested and results

3.2.1 Values tested

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<tr>
<th>Variable</th>
<th>Moments (s)</th>
<th>Reference</th>
<th>Tolerance</th>
</tr>
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<tr>
<td>( \sigma_{yy} ) (MPa)</td>
<td>2000</td>
<td>5.98289E+02</td>
<td>0.01%</td>
</tr>
<tr>
<td>( Vl )</td>
<td>2000</td>
<td>1.18814E-01</td>
<td>0.01%</td>
</tr>
</tbody>
</table>
4 Modeling B

4.1 Characteristics of modeling

Gradient of transformation imposed on the material point.

\[
\text{GRAD\_IMPOSE=} \_F (F11=F2, F22=F1, F33=F2, F12=\text{ZERO}, F13=\text{ZERO}, F21=\text{ZERO}, F23=\text{ZERO}, F31=\text{ZERO}, F32=\text{ZERO},
\]

\[
\text{with } F1 = 1 + \varepsilon_{yy} = 1 + 0.2 \frac{t}{2000}, \quad F2 = 1.
\]

4.2 Sizes tested and results

4.2.1 Values tested

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5 Summary of the results

The results are satisfactory and validate the operation of SIMU_POINT_MAT in great deformations with imposed gradient.