# Norton behaviour description

* file : Norton.mfront
* author : Helfer Thomas
* date : 23 / 11 / 06

This viscoplastic behaviour is fully determined by the evolution of the equivalent viscoplastic strain $p$ as a function $f$ of the Von Mises stress $σ\_{eq}$ :

$$\dot{p}=f\left(σ\_{eq}\right)=A σ\_{eq}^{E}$$

where :

* $A$ is the Norton coefficient .
* $E$ is the Norton exponent .

$A$ and $E$ are declared as material properties .

### List of supported Hypotheses

* AxisymmetricalGeneralisedPlaneStrain
* Axisymmetrical
* PlaneStrain
* GeneralisedPlaneStrain
* Tridimensional

## Variables

### Material properties

* YoungModulus:
	+ variable name: young
	+ variable type: stress
	+ description: the Young modulus of an isotropic material
* PoissonRatio:
	+ variable name: nu
	+ variable type: real
	+ description: the Poisson ratio of an isotropic material
* NortonCoefficient:
	+ variable name: A
	+ variable type: real
	+ description: The Norton coefficient
* NortonExponent:
	+ variable name: E
	+ variable type: real
	+ description: The Norton coefficient

### State variables

* ElasticStrain:
	+ variable name: eel
	+ variable type: StrainStensor
	+ description: la déformation élastique
* EquivalentViscoplasticStrain:
	+ variable name: p
	+ variable type: strain
	+ description: la déformation viscoplastique équivalente

### Parameters

* theta:
	+ variable type: real
	+ default value: 0.5
* epsilon:
	+ variable type: real
	+ default value: 1e-08
* iterMax:
	+ variable type: ushort
	+ default value: 100

### Local variables

* lambda:
	+ variable type: stress
* mu:
	+ variable type: stress
* T\_:
	+ variable type: temperature
* f:
	+ variable type: DstrainDt
* df\_dseq:
	+ variable type: DF\_DSEQ\_TYPE
* se:
	+ variable type: StressStensor
* seq:
	+ variable type: stress
* seq\_e:
	+ variable type: stress
* n:
	+ variable type: StrainStensor

## Code documentation

### FlowRule description

The return-mapping algorithm used to integrate this behaviour requires the definition of $f$ and $\frac{∂f}{∂σ\_{eq}}$ (see Simo and Hughes (1998) and Helfer et al. (2013) for details).

We introduce an auxiliary variable called tmp to limit the number of call to the pow function

Helfer, Thomas, Étienne Castelier, Victor Blanc, and Jérôme Julien. 2013. *Le Générateur de Code Mfront : Écriture de Lois de Comportement Mécanique*. Note technique 13-020. CEA DEN/DEC/SESC/LSC.

Simo, Juan C, and Thomas J. R Hughes. 1998. *Computational Inelasticity*. New York: Springer.