

## Operator POST\_BORDET

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### 1 Goal

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The object of this order is to calculate, in postprocessing of a calculation of nonlinear mechanics elastoplastic, the probability of cleavage resulting from the model from Bordet as well as the constraint from the model from the same name.

This order initially calculates the mechanical fields necessary to the postprocessing and from of deduced the constraint from Bordet and finally the associated probability.

It turns over a table containing:

- the constraint of Bordet according to time (with the keyword SIG\_BORDET)
- probability of Bordet according to time (with the keyword PROBA\_BORDET)

The macro-order functions in D\_PLAN, AXIS or in 3D.

The model of Bordet is described in detail in the reference material [R7.02.06].

Advices of use of this model are given in documentation [U2.05.08].

## 2 Syntax

```
[table] = POST_BORDET (  
  ♦ RESULT      = resumeca,           [result]  
  ♦ /TOUT       = 'YES',  
  /GROUP_MA    = group_ma,          [l_group_ma]  
  
  ♦ /INST       = moment,            [R]  
  /NUME_ORDRE  = order              [I]  
  ♦ /PRECISION  = \ 1E-06           [DEFECT]  
  \ prec,                                       [R]  
  ♦ /CRITERE    = 'ABSOLUTE'        [DEFECT]  
  \ 'RELATIVE',  
  
  ♦ PROBA_NUCL  = / 'NOT            [DEFECT]  
  \ 'YES'  
  
#SI PROBA_NUCL=' NON':  
  ♦ PARAM      = _F (  
    ♦ M        = m,                [R]  
    ♦ SIGM_REFE = sigma_ref,       [function]  
    ♦ VOLU_REFE = r_sup,           [R]  
    ♦ SIG_CRIT  = sigma_crit,      [R]  
    ♦ SEUIL_REFE = lim_elas_ref,   [R]  
    ♦ SEUIL_CALC = lim_elas,       [function,  
tablecloth]  
  ),  
  
#SI PROBA_NUCL=' OUI':  
  ♦ PARAM      = _F (  
    ♦ M        = m,                [R]  
    ♦ SIGM_REFE = sigma_ref,       [function]  
    ♦ VOLU_REFE = r_sup,           [R]  
    ♦ SIG_CRIT  = sigma_crit,      [R]  
    ♦ SEUIL_REFE = lim_elas_ref,   [R]  
    ♦ SEUIL_CALC = lim_elas,       [function,  
tablecloth]  
    ♦ DEF_PLAS_REFE = lim_elas,    [R]  
  ),  
  
  ♦ TEMP      = temperature,       [R, function]  
  
  ♦ COEF_MULT = \ 1,              [DEFECT]  
  \ coefficient,                   [R]  
  
)
```

## 3 Operands

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### 3.1 Operand RESULT

Indicate the result of the thermomechanical calculation for which one calculates the sizes of Bordet. The structure of data `RESULT` provided must comprise one and only one model and one and only one field material.

### 3.2 Operand TOUT/GROUP\_MA

```
♦ /TOUT          = 'YES',  
  /GROUP_MA     = group_ma,                [l_group_ma]
```

Indicate LE field of the model on which the calculation of the sizes of Bordet will be carried out. By default, it is carried out on the whole of the model. Let us note that like the model utilized variation of the plastic deformation, the group of meshes on which calculation is carried out must contain *has minimum* all the field on which the plastic deformation evolved during the loading, and which to take a larger field the result will not change (but duration of calculation).

### 3.3 Operand INST/NUMÉRIQUE\_ORDRE

```
♦ /INST          = moment,                [R]  
  /NUME_ORDRE   = order                  [I]
```

Calculation will be carried out for every moment or sequence number until the moment or number order indicated by this operand.

The result will be a table containing the various moments of calculation, the constraint and the probability of Bordet.

### 3.4 Operand PRECISION

```
♦ /PRECISION    = \ 1E-06                [DEFECT]  
                  \ prec,                [R]
```

Allows to define, in the case of the use of the keyword `INST`, a precision in the research of the last moment of calculation of the sizes of Bordet. If the precision is not defined by the user, a precision of `1E-06` is applied.

If the moment required by the user does not correspond with any interval `[moment-prec; instant+prec]` saved in the result, calculation stops in fatal error.

### 3.5 Operand CRITERION

```
♦ /CRITERE     = 'ABSOLUTE'              [DEFECT]  
                  'RELATIVE',
```

Allows to define, in the case of the use of the keywords `INST` and `PRECISION`, if the precision is absolute or relative. By default, it is absolute.

### 3.6 Operand PROBA\_NUCL

```
♦ PROBA_NUCL   = / 'NOT'                  [DEFECT]  
                  / 'YES'
```

Indicate if the user wishes to take into account the exponential term in his calculation. This term, as higher specified, is of negligible influence if  $\frac{\sigma_{ys,0} \varepsilon_{p,0}}{\sigma_{ys}(T, \dot{\varepsilon}_p)} \gg \varepsilon_p$ . If the user wishes to take into account this term, it must then inform an additional parameter which is the equivalent plastic deformation of reference. If not, this parameter is useless.

## 3.7 Operand PARAM

```
◆ PARAM = _F (
    ◆ M = m, [R]
    ◆ SIGM_REFE = sigma_ref, [function]
    ◆ VOLU_REFE = r_sup, [R]
    ◆ SIG_CRIT = sigma_crit, [R]
    ◆ SEUIL_REFE = lim_elas_ref, [R]
    ◆ SEUIL_CALC = lim_elas, [function,
tablecloth]
    ◆ DEF_PLAS_REFE = lim_elas, [R]
),
```

Indicate the whole of the parameters material necessary to the calculation of the sizes of the model of Bordet. Three first have equivalents in model of Beremin (with values which can vary from one model to another), the four following being specific to the model of Bordet.

### 3.7.1 Keyword M

```
◆ M = m, [R]
```

Appoint the exhibitor  $m$  law of the Weibull type (sometimes called factor of form).  
Caution: this size is not inevitably equal to its equivalent in the model of Beremin.

### 3.7.2 Keyword SIGM\_REFE

```
◆ SIGM_REFE = sigma_ref, [function]
```

Indicate the constraint of reference  $\sigma_u(T)$  law of the type of Weibull (sometimes called scale factor). It is the constraint for which the probability of cumulated rupture of the potential sites of cleavage is worth 1.

This constraint depends on the temperature; a function of the temperature here is expected.  
Caution: this size is not inevitably equal to its equivalent in the model of Beremin.

### 3.7.3 Keyword VOLU\_REFE

```
◆ VOLU_REFE = V0 [R]
```

Indicate the ground volume of reference  $V_0$  plastic zone.

Caution: this size is not inevitably equal to its equivalent in the model of Beremin.

### 3.7.4 Keyword SIG\_CRIT

```
◆ SIG_CRIT = sigma_crit, [R]
```

Indicate the critical stress  $\sigma_{th}$  below which the propagation of the ferritic microscopic cracks cannot be significant; if  $\sigma_1 < \sigma_{th}$  in any point, then necessarily  $P_{Bordet} = 0$ .

### 3.7.5 Keyword SEUIL\_REFE

◆ SEUIL\_REFE = lim\_elas\_ref, [R]

Indicate the yield stress  $\sigma_{ys,0}$  at a temperature of reference to be used in the model.

### 3.7.6 Keyword SEUIL\_CALC

◆ SEUIL\_CALC = lim\_elas, [function, tablecloth]

Indicate the yield stress of material  $\sigma_{ys}(T, \dot{\epsilon}_p)$ , which in any rigour depends on the temperature and the speed of plastic deformation.

If one does not know the dependence at the speed of plastic deformation, one can use for SEUIL\_CALC a simple function of the temperature.

If one knows the dependence at the same time at the temperature and the speed of plastic deformation, one can define a tablecloth; the parameter of the tablecloth must be the speed of plastic deformation, and the variable for each function the temperature (cf document user of DEFI\_NAPPE)

Example:

```
SIGY1=DEFI_FONCTION (NOM_PARA=' TEMP',  
VALE= (0. , 200. , 100. , 200. ,),  
PROL_DROITE=' CONSTANT', PROL_GAUCHE=' CONSTANT',);
```

```
SIGY2=DEFI_FONCTION (NOM_PARA=' TEMP',  
VALE= (0. , 300. , 100. , 300. ,),  
PROL_DROITE=' CONSTANT', PROL_GAUCHE=' CONSTANT',);
```

```
SIGY=DEFI_NAPPE (NOM_PARA=' EPSI',  
PROL_DROITE=' CONSTANT', PROL_GAUCHE=' CONSTANT',  
PARA= (0.0005, 0,001),  
FONCTION= (SIGY1, SIGY2),);
```

```
CALC_BORDET (..... SEUIL_CALC=SIGY,...);
```

### 3.7.7 Keyword DEF\_PLAS\_REFE

◆ DEF\_PLAS\_REFE = lim\_elas, [R]

This keyword is OBLIGATORY if PROBA\_NUCL=' OUI ' and PROHIBITED if PROBA\_NUCL=' NON '.

It indicates the equivalent plastic deformation of reference  $\epsilon_{p,0}$  who intervenes only in the exponential term.

### 3.8 Operand TEMP

◆ TEMP = temperature, [R, function]

As specified in the foregoing paragraphs, certain parameters material depend on the temperature. TEMP indicate the temperature, considered uniform for the moment on the zone of calculation of Bordet. The user can inform a reality, in which case the temperature is considered uniform spaces some and time-constant, or a function of time, in which case the temperature is considered uniform spaces some but evolutionary in time.

### 3.9 Operand COEF\_MULT

◆ COEF\_MULT = \ 1, [DEFECT]  
\ coefficient, [R]

The value by default of this coefficient is 1 . 0.

The following table, in which the thickness is noted  $e$  , indicates typical values of the coefficient  $C$  according to the type of symmetry:

- **simple symmetry** : the symmetry plane of the grid passes by the plan of the defect and the defect is entirely with a grid,
- **double symmetry** : the symmetry plane of the grid also passes by the plan of the defect but only one half of the defect is with a grid.

	<b>3D and 3D_SI</b>	<b>AXIS and AXIS_SI</b>	<b>D_PLAN and D_PLAN_SI</b>	<b>C_PLAN</b>
SIMPLE	2	$4\pi$	2nd	2nd
DOUBLE	4	without object	without object	without object
NOT	1	$2\pi$	E	E

**Table 3.9-1: Values of the multiplying coefficient symmetry-thickness**

## 4 Example of use

One will find examples in the elementary case test zzzz268 and the case test ssna108a. Advices of use of this model are given in documentation [U2.05.08].