Code_Aster

Titre : Opérateur RAFF_GP
Responsable : HABOUSSA David

Version default

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Clé : U7.03.71 Révision :
b0d83cc4b706

Macro-order `RAFF_XFEM`

1 Goal

To carry out the calculation of the criterion of error preliminary to a refinement of grid for the cracks and interfaces modelled by method X-FEM.

The order produces a structure of data `cham_no`.

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2   Syntax

```
Fr      = RAFF_XFEM

   (
      ◊ TYPE  =  /  'DISTANCE',                [DEFECT]
                 /  'ZONE'

      # SO STANDARD =/ 'DISTANCE'
      ♦  CRACK  =  (FISS1, FISS2,),        [ l_fiss_xfem ]

      # SO STANDARD =/ 'ZONE'
      ♦  CRACK  =  FISS1,                   [ fiss_xfem ]
      ♦  RAY    =  R,                       [R]

   ),
```

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3 Operation general

L'operator `RAFF_XFEM` allows to create a field in preparation for a refinement of grid within the framework of the cracks represented by method X-FEM. The idea is to characterize the nodes or the meshs located in a zone around the bottom of crack (zone of interest). That will make it possible to refine later on the meshs close to the bottom of crack, for example to improve calculation of the rate of refund of energy.

The field created by `RAFF_XFEM` can be qualified of field (or of indicator) "of error" *a priori*.

The indicator created can be of 2 types (`TYPE = 'DISTANCE'` or `'ZONE'`).

3.1 Indicator in distance

By choosing this kind of indicator, the operator `RAFF_XFEM` create a field with the nodes "of error" *a priori*. This error in each node testifies to the distance minimum of the distances to the funds of the cracks (or on surface for the interfaces).

Thus, the nodes close to the funds of cracks X-FEM (or surfaces X-FEM for the interfaces) will have a high "error". On the other hand, more the node is distant, more "the error" will be weak. This criterion is used for the software of refinement as grid, used thereafter (see for example sslp317a, b). The nodes closest to the funds of cracks will be refined in priority.

More precisely if one notes lsn the level set normal and lst the level set tangent, the field with the nodes created has as a formula:
$erreur = -r$ where r is the distance:
- at the bottom of crack for the cracks: $r = \sqrt{(lsn^2 + lst^2)}$
- with the interface for the interfaces: $r = \sqrt{(lsn^2)}$

The values of the field are thus all negative. Very distant nodes (r large) error values negative very distant from 0 and the close nodes will have (r small) will have error values negative close to 0. It will be enough to say to Lobster (`MACR_ADAP_MAIL`) to refine the meshs where the value is largest (mathematically speaking). For that, it will be necessary to specify in `MACR_ADAP_MAIL` : `USAGE_CMP = 'RELATIVE'`

One will be able is to refine a given percentage of meshs nearest to the bottom (`CRIT_RAFF_PE`), that is to say to give a value of the distance (more precisely opposite of the distance) in on this side which the meshs will be refined (`CRIT_RAFF_ABS`). For more advices, consult documentation [U2.05.02].

This indicator in distance can pose problems which we will not evoke here. This is why a second indicator, more robust, was developed.

3.2 Indicator by zone (indicating binary)

It is the indicator **advised**.

By choosing this indicator, the operator `RAFF_XFEM` create a field by mesh (field of the type `map`) of binary nature. The principle of this indicator is to be worth 1 in the zone to be refined (zone of interest) and 0 everywhere else. The zone of interest is in 2D a disc around the bottom of crack and in 3D a torus around the bottom of crack, characterized by the data of a ray R_{raff} .

For the interfaces, the zone of interest is a band around the interface.

More precisely :
The field is initialized to 0.

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The field is put at 1 if the mesh contains :
- bottom of crack (for the cracks),
- the interface (for the interfaces).

Moreover, the field is put at 1 if the mesh has at least a node located at a distance from the bottom (or interface) lower than R_{raff} . This distance is in the same way given that intervening in the indicator in distance (see § 3.1).

This indicator is easier to handle than the indicator in distance. It is used with the keyword by default of MACR_ADAP_MAIL , but exclusively with a criterion in absolute value (CRIT_RAFF_ABS). It does not matter the value of the criterion (between 0 and 1), but for questions of legibility, one advises to choose CRIT_RAFF_ABS = 0.5. One will find examples of dan useS the tests sslv155 [B, C] , sslv110f , sslp317c . Pour more advices, consult documentation [U2.05.02].

3.3   Notice common to the 2 types of indicator

It is necessary to note that the 2 indicators are based on the level sets. At present, the level sets are calculated on all the grid, but one can limit the potential zone of enrichment to a part only of the grid (keyword GROUP_MA_ENRI order DEFI_FISS_XFEM). If the level sets are likely to define a crack apart from the zone delimited by GROUP_MA_ENRI[1], the indicator calculated by RAFF_XFEM basing itself on the level sets, account of the restriction of the crack does not take. That means that certain nodes or certain meshs (apart from GROUP_MA_ENRI) will be able to have strong error values without however being close to the bottom of crack. To prevent that these nodes cause an useless refinement in this zone, it is advised to also limit the zone of refinement in MACR_ADAP_MAIL, thanks to the keyword GROUP_MA (to put the same group of meshs as that well informed under GROUP_MA_ENRI).

4   Operands

4.1   Operand TYPE

◊   TYPE   = /   'DISTANCE',   [DEFECT]
              /   'ZONE'

Allows to choose the type of indicator. By default, it is indicating outdistances some which is selected. See the description of the operation of the 2 types of indicator to the § 3 .

4.2   Operand CRACK

◊   CRACK   = (fiss1, fiss2)

(fiss1, fiss2) : list of the names of the cracks (or interfaces) as a preliminary definite by the operator DEFI_FISS_XFEM [U4.82.08]. The number of cracks (or interfaces) is not limited. For the moment, the indicator by zone functions only for one crack (or interfaces).

4.3   Operand RAY

Allows to inform the value of the ray of the zone of interest (see §3.2). This operand is not possible that for the indicator by zone.

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[1]   See the documentation of DEFI_FISS_XFEM [U4.82.08] for an illustrated example of such a case