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## Macro-command RAFF\_XFEM

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### 1 Drank

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

The command produces a data structure `cham_no`.

## 2 Syntax

```
Fr      = RAFF_XFEM

(
  ◊TYPE      =      "DISTANCE",          [DEFAULT]
              / SO STANDARD "
ZONE" # =/    "DISTANCE"
◊FISSURE    =      (FISS1, FISS2,),     [ l_fiss_xfem ]

# SO STANDARD =/ "ZONE"
◊FISSURE    =FISS1 ,                    [ fiss_xfem ]
◊RAYON      =R ,                        [R]
),
```

## 3 general Operation

operator RAFF\_XFEM makes it possible to create a field in preparation for a refinement of mesh in the frame of cracks represented by the method X-FEM. The idea is to characterize the nodes or meshes located in a zone around the crack tip (zone of interest). That will make it possible to refine later on the meshes close ones to the crack tip, for example to improve computation of rate of energy restitution.

The field created by RAFF\_XFEM can be qualified of field (or indicator) "of error" *a priori*.

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

### 3.1 Indicator outdistances some

By choosing this kind of indicator, operator RAFF\_XFEM creates a field at nodes "of error a priori". This error in each node testifies to the distance minimum of the distances to the funds of cracks (or on surface for the interfaces).

Thus, the nodes close to the funds of the 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 mesh, used thereafter (see for example sslp317a, b). The nodes closest to the crack tips will be refined in priority.

More precisely if  $l_{sn}$  the level set norm and  $l_{st}$  the level set tangent are noted, the field with the nodes created has as a formula:

$erreur = -r$  where  $r$  is the distance:

- with the crack tip for cracks:  $r = \sqrt{(l_{sn}^2 + l_{st}^2)}$
- with the interface for the interfaces:  $r = \sqrt{(l_{sn}^2)}$

the values of the field are thus all negative. The very distant nodes ( $r$  large) will have error values negative very distant from 0 and the close nodes ( $r$  small) will have error values negative close to 0. It will be enough to say to Homard (MACR\_ADAP\_MAIL) to refine meshes where the value is largest (mathematically speaking). For that, it will be necessary to specify in MACR\_ADAP\_MAIL :  
USAGE\_CMP = "RELATIF"

One will be able either to refine a percentage given of meshes nearest to bottom (CRIT\_RAFF\_PE), or to give a value of the distance (more precisely opposite of the distance) in on this side which meshes will be refined (CRIT\_RAFF\_ABS). For more advice, 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 advised **indicator**.

By choosing this indicator, operator RAFF\_XFEM creates a field by mesh (field of type card) 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 a disc around the crack tip and 3D a torus around the crack tip, is 2D characterized by the data of a radius  $R_{raff}$ .

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

More precisely :

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

The field is initialized to 0.

The field is put at 1 if the mesh contains :

- crack tip (for 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).

This indicator is easier to handle than the indicator in distance. It is used with the key word owing to lack 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 use in the tests sslv155 [B, C], sslv110f, sslp317c. For more advice, consult documentation [U2.05.02].

### 3.3 Notice common to the 2 types of indicator

It should be noted that the 2 indicators base themselves on the level sets. At the present time, the level sets are calculated on all the mesh, but one can limit the potential zone of enrichment to a part only of the mesh (key word GROUP\_MA\_ENRI of the command DEFI\_FISS\_XFEM). If the level sets are likely to define a crack apart from the zone delimited by GROUP\_MA\_ENRI1voir<sup>1</sup>, the indicator calculated by RAFF\_XFEM being based on the level sets, does not take account of the restriction of crack. That means that some nodes or some meshes (apart from GROUP\_MA\_ENRI) will be able to have strong error values without however being close to the crack tip. 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 key word GROUP\_MA (to put the same mesh group as that well informed under GROUP\_MA\_ENRI).

## 4 Operands

### 4.1 Operand TYPE

◇TYPE = "DISTANCE", [DEFAULT]  
/ "ZONE"

Makes it possible 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 FISSURES

◆ CRACK = (fiss1, fiss2)

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

### 4.3 Operand RADIUS

Makes it possible to inform the value of the radius of the zone of interest (see §3.23). This operand is possible only if for the indicator by zone.

1 the documentation of DEFI\_FISS\_XFEM [U4.82.08] for an illustrated example of such a case

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