

**User Manual**  
**Booklet U4.4- : Modelling**  
**Document : U4.42.03**

## Operator *DEFI\_COQU\_MULT*

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### 1 Aim

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To find the homogenous material properties of a multi-layer plate/shell from the properties of each layer. The following properties are taken into account :

- ply thickness,
- constitutive material,
- fibre orientation with respect to a reference axis

To produce a data structure of type `mater`.

## 2 Syntax

```
MULTI [mater] = DEFI_COQU_MULT (
    ◆ COUCHE = (_F (
        ◆ EPAIS = th , [Real]
        ◆ MATER = mat , [mater]
        ◇ ORIENTATION = / angle , [Real]
                        / 0. , [DEFAULT]
    ) )
    ◇ IMPRESSION = _F (
        ◇ FICHIER = 'RESULTAT' , [DEFAULT]
    )
)
```

## 3 Operands

### 3.1 Keyword COUCHE

- ◆ COUCHE = *\_F*

Keyword for the definition of each layer of a multi-layer composite, defined from the bottom surface to the top surface.

#### 3.1.1 Operand EPAIS

- ◆ EPAIS = *th*  
Layer thickness.

#### 3.1.2 Operand MATER

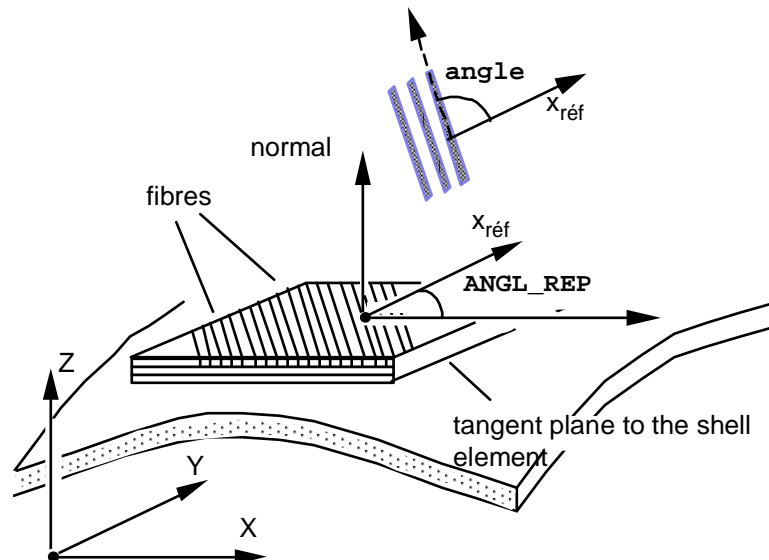
- ◆ MATER = *mat*  
The mat parameter represents the constitutive material in the layer and is produced by operator *DEFI\_MATERIAU* under the keyword factor *ELAS\_ORTH*.

#### 3.1.3 Operand ORIENTATION

- ◇ ORIENTATION = *angle*

Angle to the 1st orthotropic direction (longitudinal direction or fibre direction) in the element tangent plane and relative to the first reference line direction defined in operator *AFFE\_CARA\_ELEM* by the keyword factor *COQUE* and the keyword *ANGL\_REP* [U4.42.01].

By default *angle* is zero. If not, it must be specified in degrees and must lie between  $-90^\circ$  and  $+90^\circ$ .



### 3.2 Operand IMPRESSION

◇ IMPRESSION = \_F (

Print the list of homogenous coefficients in the RESULTAT format.

## 4 Example

```
MULTI = DEFI_COQU_MULT (
  COUCHE = (_F(EPAIS = 1.E-3, MATER = MAT1, ORIENTATION = - 20.)),
  COUCHE = (_F(EPAIS = 2.E-3, MATER = MAT2, ORIENTATION = 10.)),
  COUCHE = (_F(EPAIS = 2.E-3, MATER = MAT2, ORIENTATION = - 10.)),
  COUCHE = (_F(EPAIS = 1.E-3, MATER = MAT1, ORIENTATION = 20.)),
)
```

corresponds to the laminate:

Normal

