

## Operator COMB\_FOURIER

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### 1 Goal

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To recombine the modes of FOURIER of a structure of data `result` in particular directions. The modes are produced for a model `'AXIS_FOURIER'` by the macro order `MACRO_ELAS_MULT` [U4.51.02].

This is possible for displacements, the reactions, the fields of strains and stresses in elasticity and for the fields of temperature and flow in thermics.

The structure of data produced is of type `comb_fourier`.

## 2 Syntax

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```
comb [comb_fourier] = COMB_FOURIER (
    ♦ RESULT = resu ,                               /[fourier_elas]
                                                    /[fourier_ther]
    ♦ NOM_CHAM = | 'DEPL'
                  | 'REAC_NODA'
                  | 'SIEF_ELGA'
                  | 'EPSI_ELNO'
                  | 'SIGM_ELNO' ,
                  | 'TEMP' ,
                  | 'FLUX_ELNO' ,
    ♦ ANGLE = langl ,                               [l_R]
    )
```

## 3 Operands

### Recall:

The recombination of FOURIER on displacements is written:

$$u(\theta) = \sum_{l=0}^N \left[ \underbrace{\begin{pmatrix} \cos l \theta & 0 & 0 \\ 0 & \cos l \theta & 0 \\ 0 & 0 & -\sin l \theta \end{pmatrix}}_{A^s} u_l^s + \underbrace{\begin{pmatrix} \sin l \theta & 0 & 0 \\ 0 & \sin l \theta & 0 \\ 0 & 0 & \cos l \theta \end{pmatrix}}_{A^a} u_l^a \right]$$

A symmetrical harmonic is thus recombined with the matrix  $A^s$ , an antisymmetric harmonic with the matrix  $A^a$ .

The recombination of FOURIER on the strains and the stresses is written:

$$\varepsilon(\theta) = \sum_{l=0}^N \left( \begin{bmatrix} \cos l \theta I_4 & 0_{4,2} \\ 0_{2,4} & -\sin l \theta I_2 \end{bmatrix} \varepsilon_l^s + \begin{bmatrix} \sin l \theta I_4 & 0_{4,2} \\ 0_{2,4} & \cos l \theta I_2 \end{bmatrix} \varepsilon_l^a \right)$$

### 3.1 Operand RESULT

◆ RESULT = resu,

Name of the concept of the type `fourier_elas` or `fourier_ther` from which one will recombine the modes.

### 3.2 Operand NOM\_CHAM

◆ NOM\_CHAM = nomsymb,

Reference symbol of the recombined fields.

### 3.3 Operand ANGLE

◆ ANGLE = langl,

Angle (S) in degrees of (or of) the section (S) where place the recombination of FOURIER takes.

## 4 Example

The example below carries out a calculation on 2 harmonics of Fourier by `MACRO_ELAS_MULT`, enriches the concept of the type `RESULT` by `CALC_CHAMP` before recombining the computed fields by `COMB_FOURIER`.

Calculation Fourier on the first two symmetrical harmonics

```
resu = MACRO_ELAS_MULT (MODEL           = Mo,  
                        CHAM_MATER      = cm,  
                        CHAR_MECA_GLOBAL= bloqu,  
                        CAS_CHARGE= (  
                            _F (MODE_FOURIER = 1,  
                                TYPE_MODE   = 'SYME',  
                                CHAR_MECA   = CH,  
                                SOUS_TITRE  = 'mode Fourier 1 SYME'),  
                            _F (MODE_FOURIER = 2,  
                                TYPE_MODE   = 'SYME',  
                                CHAR_MECA   = CH,  
                                SOUS_TITRE  = 'mode Fourier 2 SYME'),),  
                        )
```

Calculation of the constraints and the nodal reactions by `CALC_CHAMP`

```
resu = CALC_CHAMP (reuse = resu,  
                  RESULT = resu,  
                  CONSTRAINT = 'SIGM_ELNO',  
                  FORCE = 'REAC_NODA',
```

Recombination of Fourier on displacements, reactions and forced for 45° and 135°

```
angl1 = 45.  
angl2 = 135.  
  
co_four = COMB_FOURIER (RESULT = resu,  
                        NOM_CHAM = ('DEPL', 'REAC_NODA', 'SIGM_ELNO'),  
                        ANGLE = (angl1, angl2),);
```