

**User Manual****Booklet U4.9- : Printing results and tests****Document : U4.91.01**

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# Procedure *IMPR\_RESU* in 'RESULTAT' and 'ASTER' formats

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## 1 Aim

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To write the mesh or the results of a calculation in a listing in 'RESULTAT' format or the mesh in 'ASTER' format.

Currently, this procedure allows the choice of writing:

- a mesh,
- node fields (displacements, temperatures, eigen modes, static modes...),
- element fields at nodes or GAUSS points (constraints, generalised forces, internal variables...).

The *IMPR\_RESU* procedure can equally allow writing of a mesh and/or results in one or several files for viewing, in particular for graphical visualisation (cf. documents [U7.05.01] ('IDEAS' format), [U7.05.11] ('CASTEM' format), [U7.05.21] ('MED' format) and [U7.05.31] ('ENSIGHT' format)). In the case of a call to the procedure *IMPR\_RESU*, it is possible to simultaneously command the program to write to several formats (with several occurrences of the keyword factor *RESU*).

For concepts of the *resultat* type, it is only possible to print one piece of information, by selecting the fields and the sequence numbers that you wish to work with.

To print a listing ('RESULTAT' format), it is possible to select the topological entities (nodes, meshes, node groups and mesh groups) for which you wish to record the results. Similarly, you can reduce the amount of data printed by not commanding certain components to be printed, values included in a user-selected range or extreme values. All these options can be combined, for example to obtain the maximum value of a given component in a particular topological entity in a user-selected range.



```
% Value selection
  ◇      VALE_MAX      =  / 'OUI',
                        / 'NON',
                        [DEFAULT]
  ◇      VALE_MIN      =  / 'OUI',
                        / 'NON',
                        [DEFAULT]
  ◇      BORNE_SUP     =  VSUP,
                        [Real]
  ◇      BORNE_INF     =  VINP,
                        [Real]

% Print coordinates
  ◇      IMPR_COOR     =  / 'OUI',
                        / 'NON',
                        [DEFAULT]

% Choice of format for printing real values
  ◇      FORMAT_R     =  /  FORM,
                        /  '1PE12.5',
                        [DEFAULT]

  ◇      SOUS_TITRE   =  L_ST,
                        [l_Kn]

  ◇      FICHIER      =  NOMFICH,
                        [Kn]

% Syntax of the IMPR_RESU procedure in 'ASTER' format
  ◆  FORMAT          =  /  'ASTER',

  ◆  |  MAILLAGE      =  MA,
                        /  [mesh]
                        /  [skeleton]
  ◇  SOUS_TITRE     =  L_ST,
                        [l_Kn]
  ◇  FICHIER        =  NOMFICH,
                        [Kn]

)
))
```

### 3 Typography in the `IMPR_RESU` documentation

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To understand the documentation for `IMPR_RESU` well, you should note that the term '`RESULTAT`' possesses three quite different meanings in *Code\_Aster*.

- a concept type,
- a file type,
- a writing format.

Effectively, on one hand, one indicates by result the quantities produced by a calculation operator in *Aster* producing several fields (time-step calculation, calculation of eigen modes, etc.)

These data (results) are contained in an *Aster* data-structure of the generic type called `resultat`. This generic type is split into two subtypes, for example `mode_meca`, `evol_elas`, etc., whose storage mode differs a little. A concept of type `resultat` has only one subtype. In the *Aster* documentation, the names of concept types are in lowercase Courier font.

On the other hand, results destined for printing, notably those issued by `IMPR_RESU`, are dumped in a file specified by the `RESULTAT` file. The writing format associated with the file to be sent for printing is also called `RESULTAT`. Therefore, it is possible to print a data-structure of the type `resultat` with `FORMAT = 'RESULTAT'` in the `FICHIER = 'RESULTAT'`.

#### Summarising:

<code>result</code>	Data output from solving the system,
<code>resultat</code>	Generic designation of the concept type (of the data-structure) which contains the result.
<code>evol_ther</code> <code>mode_meca</code>	Name of the result subtype of type <code>resultat</code> ,
<code>FICHIER</code>	(without quotation marks) designation of the file containing the results, independent of its contents' format.
' <code>RESULTAT</code> '	(With quotation marks) designation of the format ( <i>Aster</i> ) of the file containing the results.

### 4 Keyword `RESU`

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This keyword factor makes it possible to specify the results for printing and the printing format.

### 5 Writing formats

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The `IMPR_RESU` procedure allows writing of a mesh and/or values of results in a list, but equally in other viewing formats, in particular those for graphical visualisation [U7.05.01], [U7.05.11], [U7.05.21] and [U7.05.31].

#### 5.1 Operand `FORMAT`

The `FORMAT` operand allows the specification of the printing format for a result.

The '`RESULTAT`' format is selected by default. It allows printing of the mesh and/or the results in list format.

## 6 Operands CHAM\_GD and RESULTAT

The values of calculated fields are stored in data-structures called magnitude fields. These magnitude fields can be directly accessed (concept `CHAM_GD`), or located within a data-structure containing several magnitude fields (concept `resultat`).

- A magnitude field is a data-structure which allows storage of the fields defined at the nodes (`cham_no_*`) or the fields are defined per element (`cham_elem_*`). For the fields per element, distinction is made between fields defined at the element's nodes and fields defined at the element's GAUSS points.
- A `resultat` concept is made up of one or several magnitude fields. For example, at each step of the calculation the displacement magnitude field is stored in the `resultat` data-structure. This structure is therefore indexed by a second-order matrix structure, where one index is, for example, the list of the calculation times and the other is all the calculated fields (displacements, constraints, deformations, etc.)

In this case, a magnitude field is accessed by specifying a value of an access variable (order number, time step, frequency, mode number...) and a field name ('DEPL', 'SIGM\_ELNO\_DEPL', etc.). There are several types of `resultat` concept: `evol_elas`, `evol_noli`, `mode_meca`,... Each one corresponds to a list of fields and a list of permitted access variables (cf. [U5]).

On the other hand, a `resultat` concept is also assigned a certain number of complementary results (for example generalised mass or modal participation factors in a modal calculation (`resultat` concept of the type `mode_meca`)), which is different for each value of the access variable. These complementary results are called parameters.

Having taken into account the data structure of `resultat`, we can easily see that the available printing options are the magnitude fields, supplemented by these specific possibilities:

- Information on the data-structure: (for example: a list of access variables, a list of fields actually calculated, etc...),
- Selective access to a magnitude field (for example, printing the displacement field at the instant  $t=15$ ),
- Printing parameter values.

The `RESULTAT` operand allows printing of the fields contained in a `resultat` concept. For example, it can be chosen to only print certain fields (Cf. the following keyword: `NOM_CHAM`) on certain components of certain nodes (cf. `NOEUD_CMP`).

## 7 Operand SENSIBILITE

◇ `SENSIBILITE` = list of sensitivity parameters

Usage of this operand will signify that the user does not care about the result itself, but the derivative of that result with respect to some sensitivity parameters.

Example :

```
RESULTAT = RESU,
NOM_CHAM = 'DEPL'
```

This sequence prints the displacement field contained in the result `resu`.

```
RESULTAT      = RESU,
SENSIBILITE   = (PS1, PS2),
NOM_CHAM     = 'DEPL'
```

This sequence prints the derivative of the displacement field of the result `RESU` with respect to the parameter `PS1`, then the derivative with respect to `PS2`.

Cf. document [U4.50.02].

## 8 Extraction of a magnitude field

### 8.1 Operands TOUT\_CHAM / NOM\_CHAM

Cf. document [U4.71.00].

### 8.2 Operands TOUT\_ORDRE / NUME\_ORDRE / LIST\_ORDRE / NUME\_MODE / INST / LIST\_INST / FREQ / LIST\_FREQ / NOEUD\_CMP / NOM\_CAS / ANGL / PRECISION / CRITERE

Cf. document [U4.71.00].

## 9 Operand INFO\_RESU

In the printing of a *resultat* concept, it is possible to forget the exact contents of the data-structure. The operand *INFO\_RESU* allows the printing of these contents (how many order numbers, list of symbolic names of actually calculated fields, list of symbolic names of actually calculated. parameters).

For example :

```
IMPR_RESU(RESU=( _F(FORMAT='RESULTAT', RESULTAT=RESU, INFO_RESU= 'OUI')))
```

Print the file *RESULTAT* in the case of the *resultat* concept with the name *RESU* of the type *mode\_meca* :

Structure of the concept *RESU* calculated for 2 sequence numbers.

List of symbolic names:

DEPL of type DEPL\_R

List of access variable names:

NUME\_MODE  
FREQ

List of parameter names :

NORME  
METHODE  
ITER\_OR  
ITER\_BATHE  
ITER\_ARNO  
ITER\_JACOBI  
ITER\_SEPARE  
ITER\_AJUSTE  
ITER\_INVERSE  
OMEGA2  
AMOR\_REDUIT  
ERREUR  
MASS\_GENE  
RIGI\_GENE  
AMOR\_GENE  
MASS\_EFFE\_DX  
MASS\_EFFE\_DY  
MASS\_EFFE\_DZ  
FACT\_PARTICI\_DX  
FACT\_PARTICI\_DY  
FACT\_PARTICI\_DZ  
MASS\_EFFE\_UN\_DX  
MASS\_EFFE\_UN\_DY  
MASS\_EFFE\_UN\_DZ

## 10 Parameters

### 10.1 Operand TOUT\_PARA

This keyword indicates whether or not the user wants to print all the parameter values attached to the `resultat` concept and the name `RESU`.

Example :

```
IMPR_RESU(RESU=( _F(RESULTAT= RESU, TOUT_PARA= 'OUI', NUME_ORDRE= 3)))
```

The values of all the parameters are printed in the `RESULTAT` file, but only for the third step of the calculation of concept `resultat` of the type `mode_meca` :

Printing of parameters of the `resu` concept for order number 3:

```
NOM_MODE          3
FREQ              1.09787E+4
OMEGA2            4.75843E+09
AMOR_REDUIT      0.00000E+00
ERREUR            2.76853E-10
MASS_GENE         1.50009E-07
RIGI_GENE         7.13806E+02
.....
.....
NORME              SANS_CMP: LAGR
```

### 10.1 Operand NOM\_PARA

This keyword allows the choice of a list of symbolic parameter names from a list of possibilities (Cf. [U5] or `INFO_RESU`).

The keywords `TOUT_PARA` and `NOM_PARA` may not be used simultaneously.

Example :

```
IMPR_RESU(RESU=( _F(RESULTAT= RESU, NOM_PARA= ('NORME'), NUME_ORDRE= 3)))
```

The value of the parameter named 'NORME' are printed in the `RESULTAT` file, but only for the third step of the calculation of concept `resultat` of the type `mode_meca`):

Printing of parameters of the `resu` concept for order number 3:

```
NORME              SANS_CMP: LAGR
```

### 10.2 Operand FORM\_TABL

This keyword allows the choice of the printing format for parameter values. Maybe in table format with a limit of 80 characters per line (`FORM_TABL : 'OUI'`), maybe in table format where each line can reach 2000 characters (`FORM_TABL : 'EXCEL'`), maybe in list format (one parameter per line) (`FORM_TABL : 'NON'`).

By default, parameters are printed in table format.

Example :

```
1/ FORM_TABL = 'OUI'
```

```
NUME_ORDRE  NUME_MODE          ITER_QR          ITER_BATHE
FREQ        OMEGA2          AMOR_REDUIT
MASS_GENE   RIGI_GENE          AMOR_GENE
MASS_EFFE_DY  MASS_EFFE_DZ      FACT_PARTICI_DX
FACT_PARTICI_DZ  MASS_EFFE_UN_DX  MASS_EFFE_UN_DY
NORME        METHODE
```

```
2/ FORM_TABL = 'EXCEL'
```

```
NUME_ORDRE  NUME_MODE          ITER_QR          ITER_BATHE    ...
```

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## 11 Selection of components:

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Another method of reducing the volume of printed data is to only print the values of certain components (for example only the displacement along the X axis: the DX component).

### 11.1 Operand **TOUT\_CMP**

This keyword allows indication of whether or not to print all the components of a field.

### 11.2 Operand **NOM\_CMP**

This keyword allows choice of whether to print a list of components of CHAM\_GD or all the fields of the *resu* concept.

The keywords **TOUT\_CMP** and **NOM\_CMP** cannot be used simultaneously.

These components are described in the documentation specific to these elements.

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## 12 Selection of topographical entities

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In order to reduce the volume of printed data, it is sometimes necessary to only print one part of a result. To do this, one can either print only certain nodes from a node field, or only certain elements from an element field.

### 12.1 Operand **TOUT**

This keyword indicates that you wish to print the field over the entire structure (all the nodes for a node field, all the elements for an element field).

### 12.2 Operand **NOEUD**

This keyword allows indication of the list of nodes for which you wish to print a *cham\_no*. If this keyword is used when printing a *cham\_elem*, it is ignored and the *cham\_elem* is printed in all the additional meshes specified.

### 12.3 Operand **GROUP\_NO**

This keyword allows indication of the list of node groups for which you wish to print a *cham\_no*. If this keyword is used while printing a *cham\_elem*, it is ignored and the *cham\_elem* is printed in all the additional meshes specified.

### 12.4 Operand **MAILLE**

This keyword permits indication of the list of meshes for which you wish to print a *cham\_elem*. For a *cham\_no*, it allows the indication of a list of nodes and maxima of meshes for which you wish to print the *cham\_no*.

### 12.5 Operand **GROUP\_MA**

This keyword permits indication of a list of mesh groups for which you wish to print a *cham\_elem*. For a *cham\_no*, it allows indication of the list of nodes and maxima of meshes with which you wish to print the *cham\_no*.

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## 13 Selection of values

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It is equally interesting to only print the extreme values of all or certain components, for all or part of the structure.

### 13.1 Operand VALE\_MAX

This keyword indicates that you wish to print the maximum value of each component of a field, possibly in a given range specified by the arguments VSUP and/or VINF.

### 13.2 Operand VALE\_MIN

This keyword indicates that you wish to print the minimum value of each component of a field, possibly in a given range specified by the arguments VSUP and/or VINF.

### 13.3 Operand BORNE\_SUP

This keyword indicates the upper limit of the range over which the field is to be printed. All field values below this upper limit are printed.

### 13.4 Operand BORNE\_INF

This keyword indicates the lower limit of the range over which the field is to be printed. All field values above this lower limit are printed.

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## 14 Printing co-ordinates: the IMPR\_COOR operand

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This keyword allows specification of whether or not to print the co-ordinates of a node during writing of a cham\_no in 'RESULTAT' format.

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## 15 Operand FORMAT\_R

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◇ FORMAT\_R = / FORM,  
/ '1PE12.5' [DEFAULT]

Allows the specification of the format for writing real values in 'RESULTAT'.

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## 16 Comments

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In Aster, there are cham\_elem with sub-points (for cham\_elem at the nodes as well as cham\_elem at the Gauss points). In 'RESULTAT' format, IMPR\_RESU allows printing of cham\_elem with sub-points.

If the same cham\_elem has sub-points in some meshes but not in others, printing of the cham\_elem will progress in two stages:

- First printing of cham\_elem for all the meshes for which there are no sub-points,
- then printing of cham\_elem for all meshes for which sub-points exist.

A specialised format is used for each of these outputs.

## 17 Operand SOUS\_TITRE

This argument allows printing of a comment subtitle; for further details consult document [U4.03.01].

SOUS\_TITRE is by default:

- for a champ\_gd
  - for a cham\_no  
SOUS\_TITRE : ('CHAMP AUX NOEUDS' )
  - for a cham\_elem  
SOUS\_TITRE : ('CHAMP PAR ELEMENT &LOC(cham\_elem)')
- Example : "CHAMP PAR ELEMENT AUX POINTS DE GAUSS"
- for a resultat
  - for a cham\_no  
SOUS\_TITRE : ('CHAMP AUX NOEUDS',  
'DE NOM SYMBOLIQUE &NOM\_SYMB(Resultat cham\_no)&RL',  
'NUMERO D'ORDRE &NUM\_ORDRE(Resultat cham\_no)',  
'&ACCES(Resultat cham\_no)')

Example output:

```
CHAMP AUX NOEUDS DE NOM SYMBOLIQUE DEPL
NUMERO D'ORDRE: 2 NUME_MODE: 3
FREQ : 5.52739E+00
```

- for cham\_elem  
SOUS\_TITRE : ('CHAMP PAR ELEMENT &LOC(Resultat cham\_elem)',  
'DE NOM SYMBOLIQUE &NOM\_SYMB(Resultat cham\_elem)&RL',  
'NUMERO D'ORDRE &NUM\_ORDRE(Resultat cham\_elem) ',  
'&ACCES(Resultat cham\_elem)')

Example output:

```
CHAMP PAR ELEMENT AUX NOEUDS DE NOM SYMBOLIQUE
EPSI_ELNO_DEPL NUMERO D'ORDRE: 1
INST : 0.00000E+00
```

## 18 Operand FICHER

The FICHER operand is optional and permits the specification of the filename in which the user wishes to see the meshes and/or results printed.

This filename must have been previously defined by the DEBUT, POURSUITE or DEFI\_FICHER procedures.

## 19 Recording meshes: MAILLAGE / MODELE operands

This argument allows printing of a mesh in FORMAT = 'ASTER' and/or 'RESULTAT'. Review the format used for LIRE\_MAILLAGE [U4.21.01] and defined in [U3.01.00].

By default, the entire mesh is printed.

The concept of the modele type is optional in the majority of printed outputs. However, it can be used in the case of printing a mesh in 'ASTER' and/or 'RESULTAT' formats, in order to print only the part of the mesh where elements are assigned in the model.

If the 'ASTER' format is chosen, the mesh is written in a .mast file which is defined by the user in the Asterix or Lancaster interface. This file can then be re-read by LIRE\_MAILLAGE.

If the 'RESULTAT' format is chosen, the mesh is written in a .resu file and cannot be re-read by LIRE\_MAILLAGE directly because the .resu file contains additional titles, sub-titles and possibly other information.