Data-processing description of IMPR_RESU

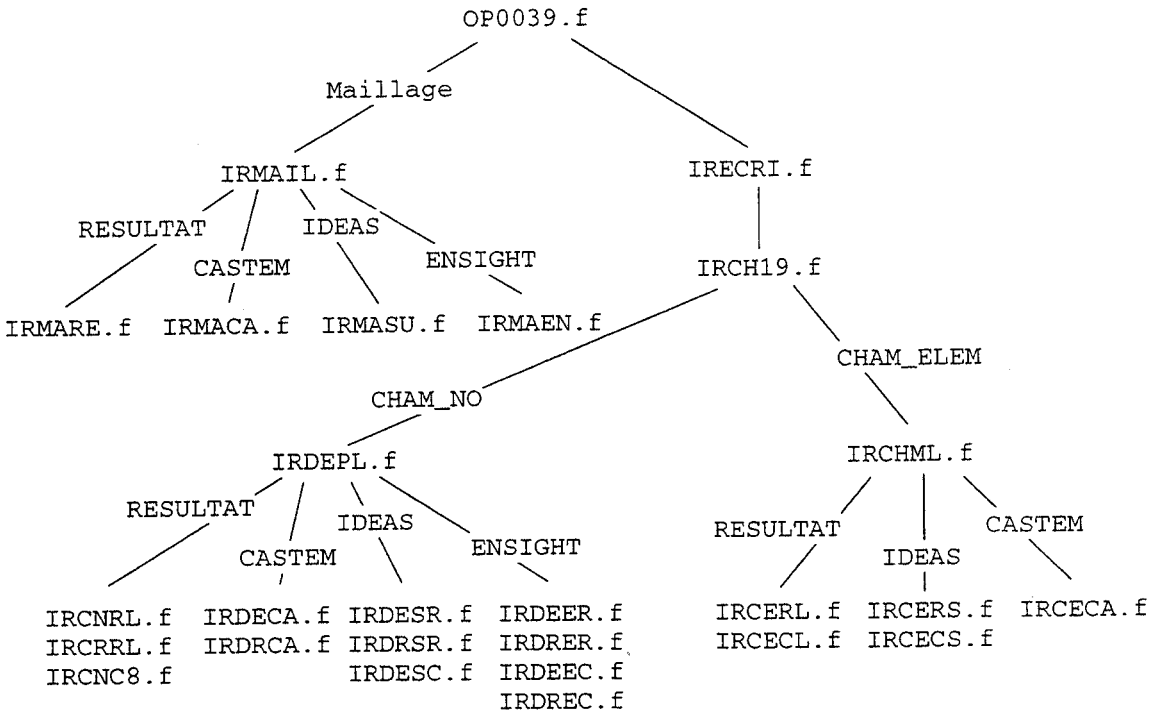
Summary :

This document is a data-processing description of the order IMPR_RESU, of which the role is to print the results of *Code_Aster* in various formats.

One finds the list of the principal routines used by the order, as well as a short summary of their features.

One describes the characteristics of the impression of the results to format I-DEAS, as well as the format of the “datasets” constituting universal file IDEAS.

1 Tree of call of the principal routines of IMPR_RESU



1.1 Description of the routines appearing in the tree of call

OP0039.f	Program main associate with the order IMPR_RESU. It is in this routine that all the operands of the order are read IMPR_RESU.
IRECRI.f	Writing of a field of size or a concept result. This routine can be called by other routines for the impression of a concept *Aster*. It is to some extent a routine “hat” for the impression of results *Aster*, deprived of any adherence to the order IMPR_RESU (not of calls to routines supervisor). It is in this routine that one finds the loops on the sequence numbers of a concept result and on the list of the reference symbols.
IRCH19.f	Routine of impression of one cham_no or of one cham_elem.
IRCHML.f	Impression of one cham_elem with real or complex components with the format RESULT, IDEAS.
IRDEPL.f	Impression of a cham_no with real or complex components with the format RESULT, IDEAS.
IRCNRL.f	Impression of one cham_no with actual values with the format RESULT (on listing). This routine also allows the research and the minimal note printing and maximum value of the field the nodes. These treatments can be carried out on all the field or only on the values belonging to an interval defined by the user.

IRCRRL.f	Impression of a cham_no with constant representation and actual values with the format RESULT. Research and impression of the values minimal and maximum. Treatment carried out on all the field or only on one interval defined by the user.
IRCNC8.f	Impression of a cham_no with complex values with the format RESULT. Research and impression of the values minimal and maximum. Treatment carried out on all the field or only on one interval defined by the user.
IRDESR.f	Impression of a cham_no with actual values with the format of universal file IDEAS (dataset 55, to see description of the structure of universal file IDEAS [§3]).
IRDRSR.f	Impression of a cham_no to constant representation and actual values with the format of universal file IDEAS (dataset 55, to see description of the structure of universal file IDEAS [§3]).
IRDESC.f	Impression of a cham_no with complex values with the format of universal file IDEAS (dataset 55, to see description of the structure of universal file IDEAS [§3]).
IRCERL.f	Impression of a cham_elem to the nodes or the points of Gauss and actual values with the format RESULT. Research and impression of the values minimal and maximum. Treatment carried out on all the field or only on one interval defined by the user.
IRCECL.f	Impression of a cham_elem to the nodes or the points of Gauss and complex values with the format RESULT. Research and impression of the values minimal and maximum. Treatment carried out on all the field or only on one interval defined by the user.
IRCERS.f	Impression of a cham_elem to the nodes or the points of Gauss and actual values with the format of universal file IDEAS (datasets 56 and 57, to see description of the structure of universal file IDEAS). **Note:** the cham_elem at the points of Gauss are written as constant fields by element, while realising on the points of Gauss).

IRCECS.f	Impression of a cham_elem to the nodes or the points of Gauss and complex values with the format of universal file IDEAS (datasets 56 and 57, to see description of the structure of universal file IDEAS). **Note:** the cham_elem at the points of Gauss are written as constant fields by element, while realising on the points of Gauss).
IRMARE.f	Impression of the grid to the format *Aster* (being able to be read again by order LIRE_MAILLAGE).
IRMASU.f	Impression of the grid to the format universal file IDEAS (datasets 15 (coordinates of the nodes single precision), 781 (coordinates of the nodes double precision), 71 or 780 (connectivities of the meshs) and 752 (groups of nodes or meshs), to see description of universal file IDEAS).

1.2 Other routines

ECRTES.f	Writing of the heading of the datasets 55.56 and 57 at the time of the writing of a field of size *Aster* with format IDEAS. This routine is called by the routines IRDESR.f, IRDRSR.f, IRDESC.f, IRCERS.f and IRCECS.f.
IRGAGS.f	Research of datasets IDEAS necessary to the writing of a field of size *Aster*. This routine is called by the routines IRDESR.f, IRDRSR.f, IRDESC.f, IRCERS.f and IRCECS.f.
IRADHS.f	Treatment of “adherences IDEAS” at the time of the writing of a grid to format IDEAS. This routine is called by the routines IRMAIL.f and IRCHML.f.
INISTB.f	Initializations necessary to the writing of a grid to format IDEAS. This routine is called by the IRADHS.f routine.
IRPARA.f	Impression of the values of the parameters and the variables of access to the format RESULT. This routine is called by the IRECRI.f routine.
RSINFO.f	Impression of the list of the reference symbols and the sequence numbers available for a concept RESULT (keyword INFO_RESU in IMPR_RESU). This routine is called by OP0039.f.

2 Structure of universal file IDEAS

The total structure of a universal file IDEAS is presented in the form of datasets characterized by their number.

Each dataset is framed by the line “- 1”:

```
- 1
n° dataset
       -
       -
       -
- 1
- 1
n° dataset
       -
       -
       -
- 1
```

Each dataset contains a particular type of information (coordinated nodes, connectivities of the meshs, results to the nodes,…), and is characterized by a number and a clean data-processing structure.

However, the numbers of dataset and their data-processing structure are not solidified and can vary from a version to another.

The order IMPR_RESU allows to print grids, and results with the nodes or by elements, and this, with the choices of the user, in version 4 or 5 of IDEAS.

So the number of datasets written by the order IMPR_RESU is reduced:

Version 4	Version 5	
151	151	Title
775	775	Properties of the beams
15		Coordinates of the nodes in single precision
	781	Coordinates of the nodes in double precision
71	780	Connectivity of the meshs
752	752	Groups of nodes and meshs
55	55	Results with the nodes (cham_no)
56	56	Results by elements (cham_elem at the point of Gauss)
57	57	Results with the nodes by elements (cham_elem with the nodes)

2.1 Dataset 151: Title

```
    - 1
    151  %  Title
    Aster  Vxx.xx.xx   date  result of the date-stamp          (A80)
       1st line of the title Aster                             (A80)
       2nd line of the title Aster                             (A80)
       white line                                            (A80)
       4th line of the title Aster                             (A80)
       5th line of the title Aster                             (A80)
       6th line of the title Aster                             (A80)
    - 1
```

This dataset is always the first dataset written in universal files IDEAS generated by the order IMPR_RESU.

2.2 Dataset 775: Properties of the beams

This dataset is obligatory when the grid comprises elements of type beam, and appears then just after the dataset 151.

```
    - 1
    775  %  Properties can section beams
     1     0      0                                          (3I10)
    BEAM1
    0.     0.     0.     0.     0.     0.                    (6
(1PE13.6))
    0.     0.     0.     0.                                  (4
(1PE13.6))
    0.     0.     0.     0.     0.     0.                    (6
(1PE13.6))
    0.     0.     0.     0.     0.     0.                       "
    0.     0.     0.     0.     0.     0.                       "
    0.     0.     0.     0.     0.     0.                       "
    0.     0.     0.     0.     0.     0.                       "
    0.     0.     0.     0.     0.     0.                       "
    0.     0.     0.     0.     0.     0.                       "
    11     7      8      14     1      10                    (6I10)
    0      45     1      11     1.
   (4I10,1PE13.6)
    - 1
```

2.3 Dataset 15: Coordinates of the nodes in single precision

If the user requests the writing of a grid from the format universal file IDEAS version 4, the coordinates of the nodes are written in single precision, in the form of this dataset.

```
    - 1
    15  % Nodes
    N      0      0      11     X      Y      Z
   (4I10,3E13.6)
    •      •      •      •      •      •      •
    •      •      •      •      •      •      •
    - 1
```

n : number of the node (it is the number *Aster* except if the grid were generated by IDEAS, in which case it is number IDEAS).

Following information relates to the definition of the frame of reference which in *Aster* is always the Cartesian reference mark, from where value 0.

The fourth information indicates the color affected during the posting of the node.

X, Y, Z are the three coordinates of the node.

With each node of the grid a line in the dataset 15 corresponds.

2.4 Dataset 781: Coordinates of the nodes in double precision

If the user requests the writing of a grid from the format universal file IDEAS version 5, the coordinates of the nodes are written in double precision, in the form of this dataset.

```
 - 1
781  % Nodes  Real*8
N      0      0      11                                    (4I10)
                                for each node
X      Y      Z                                            (3E25.17)
•      •      •      •
•      •      •
- 1
```

N: number of the node (it is the number *Aster* except if the grid were generated by IDEAS, in which case it is number IDEAS).

Following information relates to the definition of the frame of reference which in *Aster* is always the Cartesian reference mark, from where value 0.

The fourth information indicates the color affected during the posting of the node.

X, Y, Z are the three coordinates of the node.

With each node of the grid two lines in the dataset 781 correspond.

2.5 Dataset 71: Connectivities of the meshs

If the user requests the writing of a grid from the format universal file IDEAS version 4, connectivities of the meshs are written in the form of this dataset.

```
 - 1
71  % Elements
IMAS  ICOD1  ICOD2  IPHY  IMAT  7  NOAH                    (7I10)
NODSUP (J), J=1, NOAH                                     (8I10)
•       •       •      •      •       •
•
- 1
```

The two lines of information indicated are written for each element of the grid.

IMAS: Number of the mesh. It is the number *Aster* except if the grid were generated by IDEAS, in which case it is number IDEAS.

ICOD1: Graphic code of the element.

Graphic code	Mesh	Nodes	Type
1	Linear	2	Linear
2	Triangle	3	Linear
3	Triangle	6	Quadratic
4	Triangle	9	Cubic
5	Quadrilateral	4	Linear
6	Quadrilateral	8	Quadratic
7	Quadrilateral	12	Cubic
14	Tetrahedron	4	Linear
15	Tetrahedron	10	Quadratic
16	Pentahedron	6	Linear
17	Pentahedron	15	Quadratic
18	Pentahedron	24	Cubic
19	Hexahedron	8	Linear
20	Hexahedron	20	Quadratic
21	Hexahedron	32	Cubic

ICOD2: Descriptor of the finite element

By default, a value of the descriptor is assigned to each type of mesh. That is done when the user did not specify of model *Aster* and that one thus does not have the knowledge of the type of the finite element.

Type of mesh	Descriptor	
POI1	161	(lumped farmhouse)
SEG2	21	(linear beam)
SEG3	24	(parabolic beam)
TRIA3	74	(membrane linear triangle)
TRIA6	72	(membrane parabolic triangle)
TRIA9	73	(membrane cubic triangle)
QUAD4	71	(membrane linear quadrilateral)
QUAD8	75	(membrane parabolic quadrilateral)
QUAD12	76	(membrane cubic quadrilateral)
TETRA4	111	(solid linear tetrahedron)
TETRA10	118	(solid parabolic tetrahedron)
PENTA6	112	(solid linear wedge)
PENTA15	113	(solid parabolic wedge)
HEXA8	115	(solid linear brig)
HEXA20	116	(solid parabolic brig)

When the user provided a name of model, one refines these values by default by taking account of the type of the finite element. The elements concerned are:

MEAXQU4/THAXQU4	--> 84	(Quadrilateral Axi linear)
MEAXQU8/THAXQU8	--> 85	(Quadrilateral Axi parabolic)
MEAXTR3/THAXTR3	--> 81	(Axi linear triangle)
MEAXTR6/THAXTR6	--> 82	(Axi parabolic triangle)
MEDPQU4/THDPQU4	--> 54	(Strain linear Planes quadrilateral)
MEDPQU8/THDPQU8	--> 55	(Strain parabolic Planes quadrilateral)
MEDPTR3/THDPTR3	--> 51	(Strain linear triangle Planes)
MEDPTR6/THDPTR6	--> 52	(Strain parabolic triangle Planes)

MECPQU4/THCPQU4	--> 44	(Planes quadrilateral stress linear)
MEPLQU4/THPLQU4		
MECPQU8/THCPQU8	--> 45	(Planes quadrilateral stress parabolic)
MEPLQU8/THPLQU8		
MECPTR3/THCPTR3	--> 41	(Stress linear triangle Planes)
MEPLTR3/THPLTR3		
MECPTR6/THCPTR6	--> 42	(Stress parabolic triangle Planes)
MEPLTR6/THPLTR6		
MEAXSE2/MECPSE2	--> 21	(Linear beam)
MEDPSE2/MEPLSE2		
THAXSE2/THCPSE2		
THDPSE2/THPLSE2		
MEDKQU4/MEDSQU4 MEQ4QU4	--> 94	(thin hull: Quadrilateral TN linear)
MEDKTR3/MEDSTR3	--> 91	(thin hull: TN linear triangle)

IPHY: number of the table of the physical properties = number *Aster* associated with the type of mesh or the number *Aster* associated with the type of the finite element if a model were specified by the user.

IMAT: number of the table of the characteristics material = 1 except for the meshs reduced to a point in which case IMAT is worth 2.

The following recording indicates the color of the element during its posting in IDEAS (by defaults 7 green color).

NOAH: number of nodes defining the mesh.

NODSUP (J), J=1, NOAH: list of the numbers of nodes composing the mesh.

Note:

The meshs Aster not existing in IDEAS are ignored by the interface (QUAD9, HEXA27).

2.6 Dataset 780: Connectivities of the meshs

If the user requests the writing of a grid from the format universal file IDEAS version 5, connectivities of the meshs are written in the form of this dataset.

```
    - 1
   780  % Elements
   IMAS      ICOD2     1      IPHY      1      IMAT      7      NOAH
(8I10)
   NODSUP (J), J=1, NOAH
(8I10)

   % if meshs linear

   IMAS      ICOD2     1      IPHY      1      IMAT      7      NOAH
(8I10)
    0        1      1      1         1
(5I10)
   NODSUP (J), J=1, NOAH
(8I10)
   - 1
```

IMAS: number of the mesh. It is the number *Aster* except if the grid were generated by IDEAS, in which case it is number IDEAS.

ICOD2: descriptor of the finite element (see description dataset 71).

IPHY: number of the table of the physical properties (see description dataset 71).
IMAT: number of the table of the characteristics material (see description dataset 71).

The following recording indicates the color of the element during its posting in IDEAS (by defaults 7 green color).

NOAH: number of nodes defining the mesh.

Note:

To write an element of beam, there is an additional line in the dataset 780. This line defines the characteristics of the beam, inter alia, the number of the node being useful for the orientation of the principal directions of the beam. Values written by order IMPR_RESU are values can.

The meshs Aster not existing in IDEAS are ignored (QUAD9, HEXA27).

2.7 Dataset 752: Groups of nodes and meshs

```
    - 1
    752  % Groups
     NUM      0      0      0      0      NO.                          (6I10)
    NAME
(20A2)
    (ICOD, MUMENT) I=1, NO.                                          (8I10)
    .          .      .      .      .      .
    .
    .          .
    - 1
```

For each group of nodes or meshs *Aster*, one writes the instructions indicated previously.

NUM: Number of the group. It is sequential; one starts with the groups of nodes in the order of their appearance in *Aster*.

NO.: Many nodes or of meshs composing the group.

NAME: Name of the group. It is the name *Aster*.

ICOD: It is a code indicating the type of the entity the following. 7 indicates that the number which follows it is that of a node, 8 indicates that the number which follows it is that of a mesh.

NUMENT: Number of the entity (number of a node or a mesh).

Note:

The back-row forward is repeated as many times as necessary to write all the numbers of nodes or meshs composing the group.

2.8 Writing of the results *Aster* : CHAM_GD or Concept RESULT

Three datasets being used to write the results *Aster* are the datasets 55 (for fields with the nodes), 56 (for fields by elements at the points of Gauss) and 57 (for fields by elements with the nodes).

2.8.1 Dataset 55: Values with the nodes

```
- 1
55  %  Valeurs aux noeuds
TEXT1
TEXT2
TEXT3
TEXT4
TEXT5
MODTYP     ANATYP     DATCAR     DATTYP     TYPE     NBRE     (6I10)
si ANATYP=0           1    1       NUMOR                     (8I10)
                      0.0 DO
ENTETE
si ANATYP=1           1    1       1                         (8I10)
                      0.0 DO                                 (6D13.5)

si ANATYP=2           2    4       NUMOR     IMODE           (8I10)
                      FREQ MASGEN  AMOR1     AMOR2           (6D13.5)

si ANATYP=4           2    1       1         NUMOR           (8I10)
                      INST                                   (6D13.5)

si ANATYP=5           2    1       1         NUMOR
                      FREQ

NUMNOE  % Noeud (Nom du nœud dans Aster)                     (I10,A)
VALE(I), I=1, NBRE                                           (6(1PE13.5))

- 1
```

MODTYP: type of the model

MODTYP = 1 Structural
MODTYP = 2 Heat transfer

Order IMPR_RESU takes MODTYP = 1 except when the size associated with the field to be printed is TEMP or FLOW, in which case MODTYP = 2.

ANATYP: type of analysis

ANATYP	=0	UNKNOW	Value taken by default by order IMPR_RESU
	=1	STATIC	Value taken during the impression of fields of size named in *Aster*
	=2	NORMAL MODE	Value taken during the impression of a concept result having for variable of access NUME_MODE
	=4	TRANSIENT	Value taken during the impression of a concept result having for variable of access INST
	=5	FREQUENCY ANSWER	Value taken during the impression of a concept result having for variable of access FREQ and **not** NUME_MODE

DATCAR = characteristic of the data

=1	scalar
=3	vector with 6 degrees of freedom (3 translations and 3 rotations)
=4	symmetrical tensor

DATTYP = standard of the data

=0	unknown
=2	constraints
=3	deformations
=5	temperature
=6	flow
=8	displacement
=11	speed
=12	acceleration
=15	pressure

TYPE = 2 for actual values, 5 for complex values.

NO. = many values to be printed by node.

NUMOR = sequence number *Aster* for the concepts results.

IMODE = value of the variable of access NUME_MODE for the sequence number considered (for the concepts result having this variable of access).

FREQ = value of the variable of access FREQ for the sequence number considered (for the concepts result having FREQ for variable of access).

MASGEN = value of the parameter MASSE_GENE for the sequence number considered (for the concepts results having NUME_MODE for variable of access).

AMOR1 = value of the parameter AMOR_REDUIT for the sequence number considered (for the concepts result having NUME_MODE for variable of access).

AMOR2 = 0.D0

INST = value of the variable of access INST for the sequence number considered (for the concepts result having INST for variable of access).

NO. = many values of the result by node.
NUMNOE = number of the node.
VALE = values of the result (cham_no) with the node considered.

2.8.2 Dataset 56: Values by elements

```
- 1
56  %  Valeurs moyennes par élément
Text1
Text2
Text3
Text4
Text5
MODTYP      ANATYP     DATCAR     DATTYP     TYPE     NBRE      (6I10)

si ANATYP=0            1     1       NUMOR                     (8I10)
                       0.0 DO                                  (6D13.5)

si ANATYP=1            1     1       1                         (8I10)
                       0.0 DO                                  (6D13.5)

si ANATYP=2            2     4       NUMOR      IMODE          (8I10)
                       FREQ MASGEN AMOR1      AMOR2          (6D13.5)

si ANATYP=4            2     1       1          NUMOR          (8I10)
                       INST                                    (6D13.5)

si ANATYP=5            2     1       1          NUMOR          (8I10)
                       FREQ                                    (6D13.5)

NUMMAI  % Maille (Nom de la maille Aster) , NBVAL              (2I10)
VALE(I), I=1, NBVAL                                            (6(1PE13.5))

- 1
```

ENTETE

The heading of this dataset is identical to that of the dataset 55.

NUMMAI = number of the mesh.
NBVAL = many values on the mesh.
VALE = values of the result (cham_elem at the points of Gauss) on the mesh considered. cham_elem at the points of Gauss *Aster* are written with format IDEAS in the form of constant fields by element (average of the values at the points of Gauss).

2.8.3 Dataset 57: Values with the nodes by element

```
- 1
57  %  Valeurs aux noeuds des éléments
Text1
Text2
Text3
Text4
Text5
MODTYP      ANATYP     DATCAR     DATTYP     TYPE     NBRE     (6I10)

si ANATYP=0            1     1       NUMOR                    (8I10)
                       0.0 DO                                 (6D13.5)

si ANATYP=1            1     1       1                        (8I10)
                       0.0 DO                                 (6D13.5)

si ANATYP=2            2     4       NUMOR     IMODE          (8I10)
                       FREQ  MASGEN  AMOR1     AMOR2          (6D13.5)

si ANATYP=4            2     1       1         NUMOR          (8I10)
                       INST                                   (6D13.5)

si ANATYP=5            2     1       1         NUMOR          (8I10)
                       FREQ                                   (6D13.5)

NUMMAI             1         NBNOE       NBVAL               (8I10)
VALE1(I), I=1, NBVAL                                         (61PE13.5)
VALE2(I), I=1, NBVAL
  •     •     •
VALE NBNOE (I), I=1, NBVAL
```

ENTETE

The heading of this dataset is identical to that of the dataset 55 and 56.

NUMMAI = number of the mesh.
NBNOE = many nodes of the mesh.
NBVAL = many values per node.
VALEJ = values of the result (cham_elem with the nodes) on the node J mesh considered.

2.9 Writing rule of a dataset of results

In *Code_Aster*, the fields of size are fields with the nodes or fields by element at the points of Gauss or the nodes.
The fields with the nodes are written in the form of datasets number 55, the fields by elements at the points of Gauss in the form of datasets number 56 and the fields by element with the nodes in the form of datasets 57.

For the concepts result, one treats sequence number per reference symbol and sequence number by reference symbol, the various fields of size composing the concept result.

The only difference in the writing of the datasets 55.56 and 57 is the value of the code corresponds to the type of analysis (ANATYP) which is worth 1 for the fields of size named in *Aster*, and 2.4 or 5 for the concepts results (see description dataset 55).

In *Code_Aster*, a field of size is associated with a size whose list of the possible components is defined in a catalogue. The various components can be vectors, tensors or scalars.

In IDEAS, a dataset understands to the maximum 6 components, and these components are typified:

- vectors with 6 components of type displacement, speed, acceleration, flow or unknown,
- symmetrical tensors of type forced or deformations,
- scalars of type temperature or pressure.

Also, one associates with a size *Aster* a finished number of datasets IDEAS likely to be written (if the components really exist on the model). It is the IRGAGS.f routine which carries out this work.

Let us consider for example the size `DEPL_R` whose components are `DX, DY, DZ, DRX, DRY MARTINI, DRZ, GRX, DDZDN, NEAR, PHI.`

With a field with the nodes associated with this size to the maximum three datasets IDEAS corresponds (all three of number 55):

- a dataset of type vector with 6 components for the writing of `DX, DY,… DRZ`,
- a dataset of the scalar type for the writing of `NEAR`,
- a dataset of the unknown type for the writing of the components `GRX, DDZDN, PHI`.

These datasets can then exist or not according to the presence or not components. The dataset exists as soon as one of the components the component is defined on a node of the grid (in which case the value of the components absent is 0.).

With regard to the internal variables, one generates one or more (a dataset understands to the maximum 6 components) datasets of number 55 and type “UNKNOWN”.

3 Bibliography

[1] User' S Guides “Core utilities”. I-DEAS. SDRC.