

Operator MODI_CHAR_YACS

1 Goal

The object of this order is to recover (*via* YACS) efforts imposed by the fluid on the structure. This field of force is project on the grid structure with the interface fluid-structure and is then added with the preexistent mechanical loading.

This operator is used by the macro-order `CALC_IFS_DNL` (*cf.* U7.06.01 documentation) which allows calculations fluid-structures coupled in non-linear transitory mode. For that, one comes to couple *Code_Aster*, for the structure part, with *Code_Saturne*, for the fluid field, *via* supervisor YACS of Salomé.

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2 Syntax

```
resu [char_meca] = MODI_CHAR_YACS (
    ♦ reuse          = charmeca,      [char_meca]
    ♦ CHAR_MECA      = charmeca,      [char_meca]
    ♦ MATR_PROJECTION = matrproj,    [ corresp_2_mailla ]
    ♦ NOM_CMP_IFS    = lcompifs,     [l_Kn]
    ♦ VIS_A_VIS = ( _F (
        ♦ GROUP_MA_1 = lgma1 ,      [l_gr_maille]
        ♦ GROUP_NO_2 = lgno2 ,      [l_gr_noeud]
        ), ),
    ♦ INST           = inst,         [R]
    ♦ NOT            = not,          [R]
    ♦ NUME_ORDRE_YACS = numyacs,     [I]
    ♦ INFORMATION    = / 1 ,         [DEFECT]
                          / 2 ,
) )
```

3 Principle of operation

Method of coupling for the interaction fluid-structure based on *Code_Aster* and *Code_Saturne* require the data exchange between these codes. Indeed, it is not about a monolithic approach where all the coupled problem would be solved in a single computer code: one couples two codes, each one being confined with his speciality. This coupling is managed by the order `CALC_IFS_DNL` (U7.06.01).

All the data to be exchanged use protocol YACS of Salomé.

These data can be of two different nature:

- parameters of smalls (of the scalars, for example),
- fields (grids, displacements, speeds or efforts with the interfaces, for example).

In order to keep a good modularity, favourable with the evolutions, different operators were thus developed, each one treating one of the types of data to be exchanged.

The scalar data are handled by `RECU_PARA_YACS` (U7.06.21), fields by `ENV_CINE_YACS` (U7.06.11) and `MODI_CHAR_YACS` (U7.06.22) or the operator `IMPR_MAIL_YACS` who recovers, via YACS, the fluid grids of the interfaces. All these orders are called by `CALC_IFS_DNL`.

The operator `MODI_CHAR_YACS` allows to take into account the efforts due to the fluid the interface fluid-structure, a given moment. This stage of the coupling fluid-structure, which one must reactualize with each step of time (even iteration into implicit) breaks up as follows:

- by a call YACS, one recovers the efforts with the interface (which are defined on the fluid grid),
- thanks to the structure of data of the type `corresp_2_mailla` generated by `PROJ_CHAMP` (U4.72.05), one will project this fields on the grid structure with the interface,
- this field project is finally added with the preexistent mechanical loading.

This order will thus modify a structure of existing data of type `char_meca`.

To be able to use this functionality it is thus necessary to lay out, as a preliminary, of a mechanical loading and a structure of data `corresp_2_mailla` for projection.

4 Keyword CHAR_MECA

This obligatory keyword makes it possible to specify the mechanical loading which one will modify.

5 Keyword MATR_PROJECTION

This keyword makes it possible to define the matrix of projection of the fluid grid towards the solid grid (structure of data of the type `corresp_2_mailla` calculated with `PROJ_CHAMP`).

6 Keyword NOM_CMP_IFS

This keyword allows to specify which components of the fluid field of force one wants to apply to the structure. For example, if one wants to apply all the components for a model 3D, one will write:

```
NOM_CMP_IFS = ('FX', 'FY', 'FZ')
```

One can thus, contrary, not to take account of certain components, according to the needs.

7 Keyword VIS_A_VIS

Like `MODI_CHAR_YACS` in-house fact a stage of projection, one finds part of syntax of `PRO_CHAMP`. One thus returns towards documentation u4.72.05 for the keyword factor `VIS_A_VIS` and its keyword simple `GROUP_MA_1` and `GROUP_NO_2`. For the coupling fluid-structure, `GROUP_MA_1` corresponds to the meshes of the grid structure on the level of the interface fluid-structure and `GROUP_NO_2` point on the group of nodes of the fluid grid in opposite to the interface.

8 Keyword INST, NOT and NUME_ORDRE_YACS

MODI_CHAR_YACS need for a communication YACS has to read the fluid efforts at a given moment. However, communications YACS need certain arguments as starter:

- the moment running given by the keyword INST,
- the last step of time known with the keyword NOT,
- the call number YACS (sequence number managed by CALC_IFS_DNL).

These parameters, which depend on the current moment, are managed automatically by CALC_IFS_DNL.