Macro-order POST_NEWMARK

1 Goal

To check the stability of a work in fill in 2D (dam/stopping) according to the criterion of maximum horizontal displacement acceptable during a seismic loading via the method of Newmark [1].
The procedure depends as starter on the concept result of a temporal linear calculation dynamic or not linear, as well as position of the potential rings slip and of the associated seismic coefficient.
macroorder provides in exit a table containing the horizontal average acceleration of the slipping mass and horizontal displacement.

2 Syntax

```
resu [table] = POST_NEWMARK (

    ♦  RESULT           = result,            [dyna_trans,evol_noli]
    ♦  KY                        = ky,                    [R]
    ♦   GROUP_MA_CALC            = grpma ,                [ grma ]
    ◊  RAY                    = ray,              [R]
        # If RAY
        {
          ♦  CENTRE_X             = posx,                [R]
          ♦  CENTRE_Y             = posy,                [R]
        }
    ◊  MAILLAGE_GLIS          = e-mail,              [sd_maillage]
        # If MAILLAGE_GLIS
        {
          ◊  GROUP_MA_GLIS    = grma_gls,            [ grma ]
          ◊  GROUP_MA_LIGNE      = grma_lgn,             [ grma ]
        }
```

3 Description of the macro-order

The macro-order POST_NEWMARK allows to obtain an estimate of the irreversible side displacement of a potential zonelies slipping of a work in fill (stopping/dam) via the method of Newmark [1].

The method of Newmark is based on the idea that the zone potentially slipping of the work can be approximate by a block slipping on a tilted level. During the earthquake, this block slips along the tilted plan when L'average acceleration (a_m) block exceed a fixed value, called critical acceleration (a_y). The method considers that the residual displacement of the slipping block can be obtained while integrating twice moments of the average acceleration exceeding critical acceleration.

From a dynamic calculation of standard elementS stop, the average acceleration of a zone potentially slipping is definedE like LE quotient of the resultant of the lateral forces F_L along the interface between the zone potentially slipping and the rest of the work and the mass m of this zone:

$$a_m = \frac{F_L}{m} \quad (1)$$

Critical acceleration is definedE like acceleration who carries out with a safety coefficient of value $1{,}0$ for the zone potentially slipping. With to leave critical acceleration, one definite the seismic coefficient k_y by bringing back acceleration criticizes with the value of the acceleration of gravity g :

$$k_y = \frac{a_y}{g} \quad (2)$$

The macro-order POST_NEWMARK accept only grids 2D and two types of zones of slip:

- a circular simple form, whose position is provided by the user,
- a form defined starting from an auxiliary grid, which must be positioned on the place geometrical of the mass which slips.

The seismic coefficient k_y must be provided by the user as starter of the macro-order. He can be obtained by a calculation of stability pseudo-statics with a nonlinear law of behavior integrating a criterion of rupture.

One will be able to consult: the CAS-test zzzz402 [V1.01.402] based on the dynamic response of a work in fill on earthquake.

[1] Newmark, N.M. 1965. Effects of earthquakes one prejudices and embankments. Geotechnics, 15(2): 139-160.

4 Operands

4.1 Operands RAY, CENTRE_X, CENTRE_Y

♦ RAY = ray

Radius of the circle of slip for which the work Dhears checked being

♦ CENTRE_X = posx

Position according to coordinate X of the center of the circle of slip

♦ CENTRE_Y = posy

Position according to the coordinate Y of the center of the circle of slip

Notice 1 :

The order POST_NEWMARK draft only works modelled according to a geometry 2D. Lorder has stop in fatal errorE if grid used is 3D.

Notice 2 :

The user must check the adequacy of the provided position of the circle of slip and the grid on which dynamic calculation was carried out.

4.2 Operand RESULT

♦ RESULT = result

This obligatory operand makes it possible to inform the concept result integrating the seismic answer of the work.

Note:

In the case of one result of type dyna_ trans , it is necessary that the user calculate beforehand field of constraints of type SIEF_ELGA . This operation is carried out with the order CALC_CHAMP (see case test zzzz402a).

4.3 Operand KY

♦ KY = ky

This operand makes it possible to inform the value seismic coefficient obtained for the circle of slip and for which the work must be checked.

4.4 Operand GROUP_MA_CALC

♦ GROUP_MA_CALC = grma

This obligatory operand makes it possible to inform the whole of the groups of meshs on which dynamic calculation was carried out. These groups of meshs are used in order to determine the meshs belonging to the circle of slip.

4.5 Operand MAILLAGE_GLIS

◊ MAILLAGE_GLIS = e-mail

This operand makes it possible to provide the auxiliary grid which will be used like “patch” for the calculation of stability. This grid must be positioned geometrically on the zone which slips and have the meshs SEG2 or SEG3 for the line of slip.

4.6 Operand GROUP_MA_GLIS

◊ GROUP_MA_GLIS = grma_gls

This operand makes it possible to the user to provide the surface group of meshs grma_gls grid e-mail on which he wants to define the patch. If the keyword is not indicated, the patch consists of all the surface meshs of the grid e-mail.

4.7 Operand GROUP_MA_LINE

◊ GROUP_MA_LIGNE = grma_lgn

This operand makes it possible to the user to provide the group of linear meshs grma_lgn grid e-mail defining the line of slip . If the keyword is not indicated, the line of slip is made upE of all the meshs linear of type SEG2 and SEG3 grid e-mail .