Modeling POU_D_T_GD

Summary:

This document describes for modeling POU_D_T_GD :

- degrees of freedom carried by the finite elements which support modeling,
- the related meshs supports,
- supported loadings,
- nonlinear possibilities,
- CAS-tests implementing modeling.

Modeling POU_D_T_GD to a formulation of elements of beams of fascinating Timoshenko of account corresponds great displacements and great rotations (cf [R5.03.40]).

It is usable for problems of three-dimensional beams in isotropic mechanical analysis and linear elastic behavior.

Contents

1 Discretization

1.1 Degrees of freedom

The degrees of freedom are, in each node of the mesh support, the six components of displacement (three translations and three rotations).

Finite element	Degrees of freedom (with each node top)					
POU_D_T_GD	DX	DY	DZ	DRX	DRY MARTINI	DRZ

1.2 Mesh support of the matrices of rigidity

The meshs support of the finite elements, in displacement formulation, are segments with two nodes SEG2 :

Modeling	Mesh	Finite element	Remarks
POU_D_T_GD	SEG2	MECA_POU_D_T_GD	

2 Assignment of the characteristics

For these elements of structures 1D, it is necessary to affect geometrical characteristics which are complementary to the data of grid. The definition of these data is carried out with the order AFFE_CARA_ELEM associated with the keywords following factors:

- **BEAM**
  Allows to define and affect the characteristics of the cross section.

- **ORIENTATION**
  Allows to define and affect the main axes of the cross sections of the elements of type beam.

3 Supported loadings

Loadings specific, available in AFFE_CHAR_MECA are the following:

- **'EPSI_INIT'**
  Allows to apply a loading of initial deformation.

- **'FORCE_POUTRE'**
  Allows to apply linear forces.

- **'GRAVITY'**
  Allows to apply a loading of type gravity.

- **'INTE_ELEC'**
  Allows to apply the force of LAPLACE acting on a principal driver, due to the presence of a secondary driver not necessarily right compared to this principal driver.

4 Non-linear possibilities

4.1 Law of behaviors

The law of behavior specific to this modeling, usable under BEHAVIOR in STAT_NON_LINE and DYNA_NON_LINE is the relation ELAS_POUTRE_GR (Cf [U4.51.11]).

4.2 Deformations

Only deformation 'GROT_GDEP'allowing to treat the beams in great displacements and great rotations is available (cf [U4.51.11]). The deformations used in the relation of behavior are the deformations of GREEN-LAGRANGE.

5 Examples putting work modeling: CAS-test

- Non-linear statics
  - SSNL103A [V6.02.103]: Calculation of the static deformation in great displacements and great rotations of a beam fixed at an end and subjected to one bending moment at the other end.
- Non-linear dynamics
  - SDNL103A [V5.02.103]: Analysis answer of a gantry embedded in feet and subjected to a dynamic force applied in the middle of its span and perpendicular to its plan.