Modelings AXIS_SI, D_PLAN_SI, C_PLAN_SI

Summary:

Modelings AXIS_SI, D_PLAN_SI, C_PLAN_SI (Phenomenon: MECHANICS) correspond to finite elements whose meshs supports are surface.

The suffix _SI mean: Under - Integrated: the integration of the terms relating to the laws of behavior is made in a reduced way (diagram of points of Gauss of a nature less low than modeling with complete integration).

The assumptions of modeling are the following ones:

- AXIS_SI for the axisymetry (mode 0 of Fourier) according to the axis of Y,
- D_PLAN_SI for the plane deformations,
- C_PLAN_SI for the plane constraints.

This document describes for modelings:

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

1 Discretization

1.1 Degrees of freedom

Modeling	Degrees of freedom (with each node top)
AXIS_SI	DX : corresponds to radial displacement DY : corresponds to longitudinal displacement
D_PLAN_SI	DX : following displacement X DY : following displacement Y
C_PLAN_SI	DX : following displacement X DY : following displacement Y

1.2 Mesh support of the matrices of rigidity

The meshs support of the finite elements can be triangles or quadrangles. The elements are isoparametric. Only the element which is pressed on mesh QUAD8 under is integrated.

Modelings	Mesh	Interpolation	integration
AXIS_SI	TRIA3	Linear	complete
D_PLAN_SI	QUAD4	Bilinear	reduced
C_PLAN_SI	TRIA6	Quadratic	complete
	QUAD8	Serendip	reduced
	QUAD9	Biquadratic	complete

1.3 Mesh support of the loadings

Modelings	Mesh	Interpolation
AXIS_SI	SEG2	Linear
D_PLAN_SI		or
C_PLAN_SI	SEG3	Quadratic

2 Supported loadings

The loadings available are the following:

- **EPSI_INIT**

  Allows to apply a loading of initial deformation.

  Supported modelings: AXIS_SI, C_PLAN_SI, D_PLAN_SI

- **GRAVITY**

  Allows to define the acceleration and the direction of gravity.

  Supported modelings: AXIS_SI, C_PLAN_SI, D_PLAN_SI

- **ROTATION**

  Allows to define a number of revolutions and the direction of the vector of rotation.

  Supported modelings: AXIS_SI, C_PLAN_SI, D_PLAN_SI

- **CONTACT**

  Allows to define the zones subjected to conditions of contact.

  Supported modelings: AXIS_SI, C_PLAN_SI, D_PLAN_SI

- **FORCE_CONTOUR**

  Allows to define linear forces at the edge of a field.

  Supported modelings: AXIS_SI, C_PLAN_SI, D_PLAN_SI

- **FORCE_INTERNE**

  Allows to define voluminal forces.

  Supported modelings: AXIS_SI, C_PLAN_SI, D_PLAN_SI

- **PRES_REP**

  Allows to apply a pressure.

  Supported modelings: AXIS_SI, C_PLAN_SI, D_PLAN_SI

3 Non-linear possibilities

3.1 Laws of behaviors

Laws of behaviors (model classics, local models with damage, models for the concrete and grounds, …), usable under BEHAVIOR in STAT_NON_LINE and DYNA_NON_LINE, under the keyword RELATION, are described in details in the document “Behavior nonlinear” [U4.51.11].

3.2 Deformations

Deformations usable under BEHAVIOR in STAT_NON_LINE and DYNA_NON_LINE, under the keyword DEFORMATION, are described in details in the document ‘Behavior nonlinear’ [U4.51.11].

4 Examples of implementation: CAS-tests

- **AXIS_SI**
  - Non-linear statics
    SSNA113A [V6.01.113]: Analysis of an axisymmetric test-tube notched with a law of behavior of the type ‘VISC_ISOT_TRAC’ subjected two-speed of loading.
  - Nonlinear dynamics
    SDNV103B [V5.03.103]: Impact of a bar of Taylor: analysis of the impact rubbing of an elastoplastic bar on a rigid solid mass. Modeling understands: contact, friction, elastoplasticity and great deformations.

- **D_PLAN_SI**
  - Non-linear statics
    SSNP123A [V6.03.123]: Analysis of a notched rectangular plate made up of an elastoplastic material with isotropic work hardening, subjected to a traction at its ends.
  - Non-linear statics
    CENTE01A [V1.02.001]: Probability calculus of rupture per cleavage of a resilience test specimen (test-tube of Charpy) impacted by a hammer at a speed of 5m/s.
    SSNP117A [V6.03.117], SSNP122A [V6.03.122]: Model of Rousselier