

Modeling SHB

Summary:

This document describes for modeling SHB :

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

This modeling understands the element SHB8-PS (developed by Alain Combescure, S. Baguet, Insa Lyon) which is pressed on a mesh HEXA8. The element has 5 points of integration, distributed in the thickness. It under-is integrated to have good performances. To avoid blockings the modes of hourglass are stabilized by the "Assumed strain method". It functions into linear, nonlinear geometrical and material (behavior VMIS_ISOT_TRAC only).

It also understands elements SHB6 (pentahèdre linear), SHB15 and SHB20 (quadratic elements).

1 Discretization

1.1 Degrees of freedom

Modeling	Ddl with all the nodes
SHB	DX, DY, DZ

1.2 Mesh support of the matrices of rigidity

For modeling SHB, the meshes support of the finite elements are hexahedrons with 8 nodes and pentahedrons with 6 nodes for the linear elements, of the hexahedrons with 20 nodes and the pentahedrons with 15 nodes for the quadratic elements.

Modeling	Mesh	Interpolation in displacements
SHB	HEXA8	Linear
SHB	PENTA6	Linear
SHB	HEXA20	Quadratic
SHB	PENTA15	Quadratic

1.3 Mesh support of the surface loadings

Modeling	Mesh	Interpolation in displacements
SHB	QUAD4	Linear
SHB	TRIA3	Linear
SHB	QUAD8	Quadratic
SHB	TRIA6	Quadratic

2 Supported loadings

The loadings available are the following:

- `'FORCE_ARETE'`
Allows to apply forces linear, with one edge of element voluminal.
- `'FORCE_FACE'`
Allows to apply surface forces on one face of voluminal element.
- `'FORCE_INTERNE'`
Allows to apply voluminal forces.
- `'GRAVITY'`
Allows to apply a loading of type gravity.
- `'PRES_REP'`
Allows to apply a pressure to a field of continuous medium.

3 Non-linear possibilities

3.1 Law of behavior

The law of behavior available under BEHAVIOR in STAT_NON_LINE is defined by the relation VMIS_ISOT_TRAC (Cf [U4.51.11]).

3.2 Deformations

Deformations available, used in the relations of behavior under the keyword DEFORMATION in STAT_NON_LINE are (cf [U4.51.11]):

/ \ SMALL \

The deformations used for the relation of behavior are the linearized deformations.

/ \ GREEN \

The deformations used in the relation of behavior are the deformations of GREEN_LAGRANGE.

4 Examples of implementation: CAS-tests

- Linear statics
SSLS124A [V3.03.124]: Analysis quasi-static of a beam in inflection, embedded at an end and subjected to a vertical force at the other end.
- Non-linear statics
SSNS101A [V6.05.101]: Geometrical non-linear static analysis (breakdown) of a cylindrical panel under a specific force.
- Linear dynamics
SDLS109H [V2.03.109]: Research of the Eigen frequencies and the modes associated with a thick cylindrical ring.