

Modelings HULL, COQUE_PLAN, COQUE_AXIS - Phenomenon THERMICS

Summary:

This document describes for thermal modelings of the axisymmetric elements and plans:

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

Modeling HULL Phenomenon THERMICS [R3.11.01] is usable to treat the equations of heat in mediums with average layer in linear thermal analysis. One can use it like the first calculation of a thermomechanical chaining with the corresponding machine elements.

1 Discretization

1.1 Degrees of freedom

The degrees of freedom are the temperatures `TEMP` (temperature on the average surface of the hull), `TEMP_INF` (temperature on the lower surface of the hull), and `TEMP_SUP` (temperature on the upper surface of the hull).

1.2 Meshes support of the matrices of rigidity

Modeling	Mesh	Finite element	Remarks
HULL	TRIA3	THCOTR3	nodes with 3 coordinates x, y, z
	TRIA6	THCOTR6	
	TRIA7	THCOTR7	
	QUAD4	THCOQU4	
	QUAD8	THCOQU8	
	QUAD9	THCOQU9	
COQUE_PLAN	SEG3	THCPSE3	nodes with 2 coordinates x, y
	COQUE_AXIS	THCASE3	

For `THCOTRi`, only the 3 tops are exploited to define the local geometry (tangent plan, normal). For `THCOQUi`, it is considered that the element is plan and its tangent plan is defined by default by 3 of the 4 tops of the element.

1.3 Mesh support of the loadings

All the loadings applicable to the facets of the elements of hull are treated by direct discretization on the mesh support of the element in temperature formulation.

No mesh support of loading is thus necessary for the faces of the elements of hulls.

For the applicable loadings on the edges of the elements of hull or plate of modeling - hull, a mesh support of the type `SEG2` or `SEG3` must be used.

Modeling	Mesh	Finite element	Remarks
HULL	SEG2	THCOSE2	with <code>TRIA3</code> and <code>QUAD4</code>
HULL	SEG3	THCOSE3	with <code>TRIA6</code> or <code>TRIA7</code> and <code>QUAD8</code> or <code>QUAD9</code>

For the imposed temperatures, the meshes support are meshes reduced to a point.

2 Assignment of the characteristics

For these elements of thermal structures, 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 `AFPE_CARA_ELEM` associated with the keyword following factor:

- **HULL**
Allows to define and affect the thickness on the meshes.

3 Supported loadings

The loadings available are the following:

- **FLUX_REP**

Allows to apply normal flows to faces of elements of hulls to the faces \pm .

Supported modelings: HULL, COQUE_PLAN, COQUE_AXIS

- **EXCHANGE**

Allows to apply conditions of exchange with an outside temperature with faces of hulls to the higher and lower faces.

Supported modelings: HULL, COQUE_PLAN, COQUE_AXIS

4 Non-linear possibilities

Nothing.

5 Transitory possibilities

Only modeling HULL allows to deal with the evolutionary problems of thermics.

6 Examples of implementation: CAS-test

- **HULL**

- Stationary linear thermics

- HPLA100C [V7.01.100]: Analysis of a heavy thermoelastic hollow roll in uniform rotation. In this modeling, one carries out a chained thermoelastic calculation and a thermoelastoplastic calculation without plastic evolution.

- TPLS100A [V4.03.100]: Thermal analysis in stationary mode of an infinite plate subjected to a couple of antisymmetric heat flows on its two half - faces.

- Transitory linear thermics

- TTLL01M [V4.21.001]: Linear transitory thermal analysis of an infinite wall subjected to a thermal shock.

- **COQUE_PLAN**

- Stationary linear thermics

- HPLA100B [V7.01.100]: Analysis of a heavy thermoelastic hollow roll in uniform rotation. In this modeling, one carries out a chained thermoelastic calculation and a thermoelastoplastic calculation without plastic evolution.

- TPLS100B [V4.03.100]: Thermal analysis in stationary mode of an infinite plate subjected to a couple of antisymmetric heat flows on its two half - faces.