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 meshs 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 Meshs 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	SEG3	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 TRIA3 and QUAD4
HULL	SEG3	THCOSE3	with TRIA6 or TRIA7 and QUAD8 or QUAD9

For the imposed temperatures, the meshs support are meshs 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 AFFE_CARA_ELEM associated with the keyword following factor:

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

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 ±.

  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.