Radiation Between Surfaces - Pre-Analysis & Start-up

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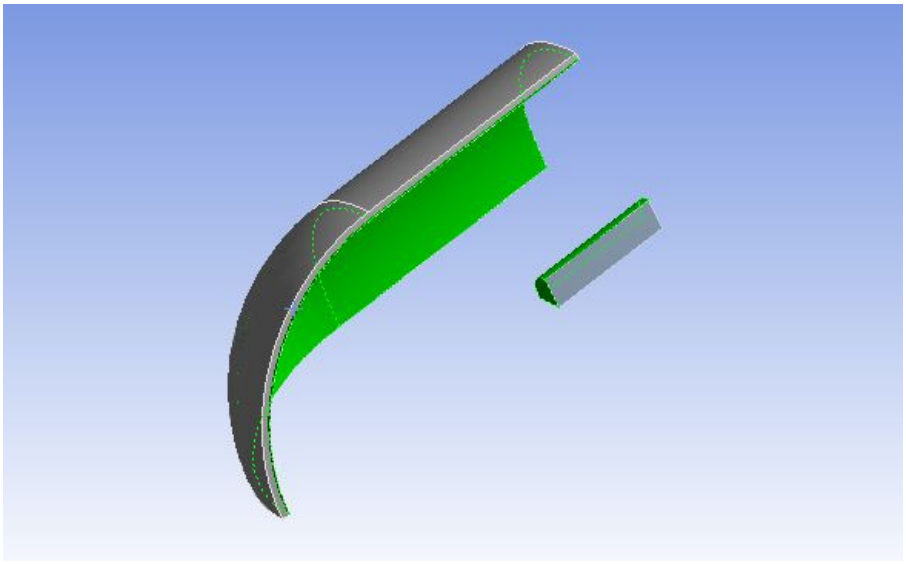
Pre-Analysis & Start-Up

Model

We are interested in finding the radiation exchanged between the shell and the specimen surface. We will run a steady state thermal analysis to set the initial conditions of the model. Then we will transfer the initial conditions to transient thermal to complete the radiation analysis. Symmetry boundary conditions are added to the transient thermal model. This is essential to problems involving radiation because it enables the FEA code to compute the view factor between the surfaces in the full model. It is possible to run a full model without symmetry boundary conditions but this example will run faster with 1 /8 symmetric model. The following picture shows the 1/8 model and the radiating surfaces in green.



Radiation

Radiation heat transfer can be derived from the Stefan-Boltzmann Law:

$$Q_R = \sigma \varepsilon F A \left(T_{surface}^4 - T_{ambient}^4 \right)$$

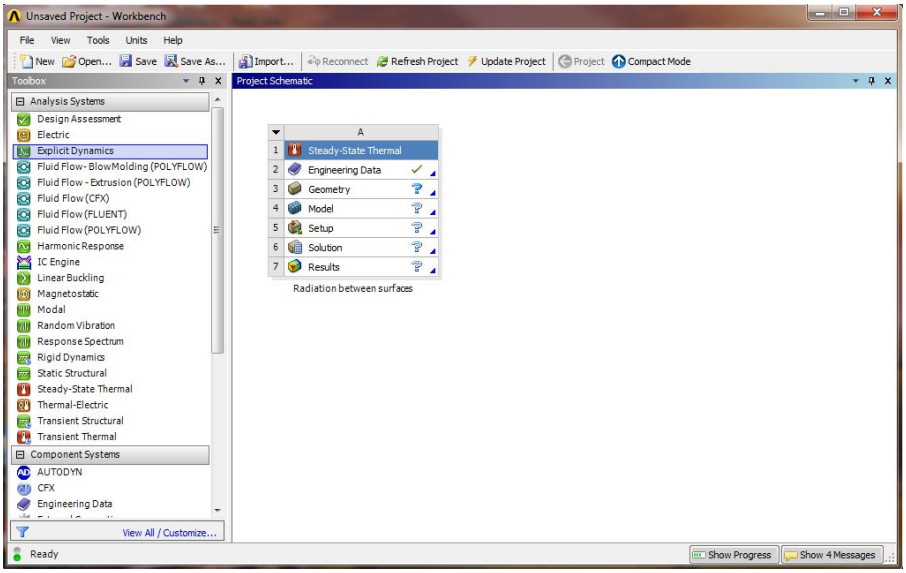
Where:

- σ = Stefan-Boltzman constant
- ε = Emissivity
- A = Area of radiating surface
- F = Form factor (1)

The above radiation equation provides correlations for radiation to ambient (form factor assumed to be 1) or surface to surface (view factor calculated).

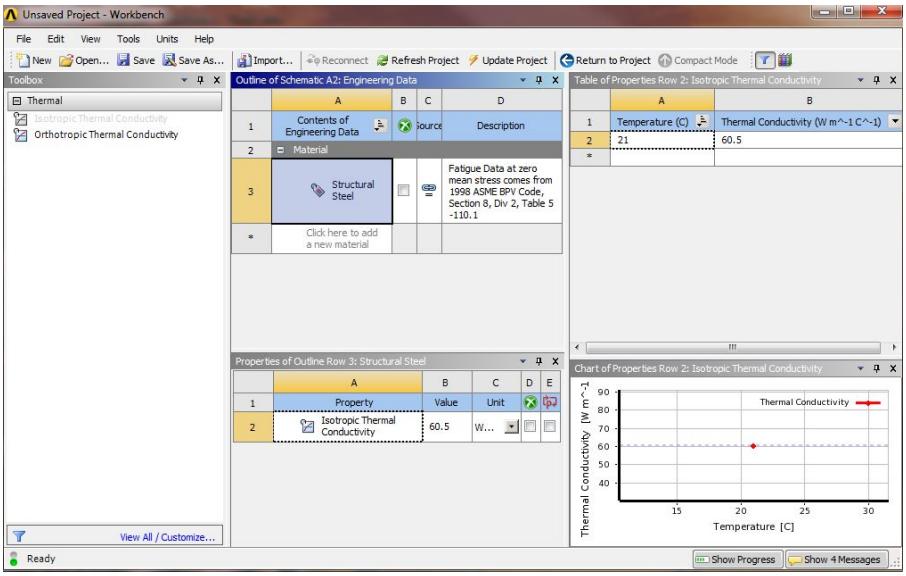
Start-Up

Open ANSYS workbench and drag the ***Steady State Thermal*** icon from the toolbox to Project Schematic. Name the project Radiation between surfaces.



Engineering Properties

Double click on ***Engineering Data*** to open the Engineering Data page. Check that ***Structural Steel*** appears as the default material.



Note

Only the ***isotropic thermal conductivity*** is specified in steady state analysis. We will need to add additional properties before we proceed to the transient thermal analysis.

Leave the material properties unchanged and move on to create the geometry.

Go to Step 2: Geometry

Go to all ANSYS Learning Modules