

Front and Reverse Element Sides

2D elements can radiate from their front side and/or their reverse side. The front element side is defined solely by the node connectivity, and corresponds to the +Z axis of the element triad.

Front and Reverse Side Optical Material Properties

How (and whether) a 2D element radiates is determined by the optical material properties of its front and reverse sides. Generally, optical material properties are defined (just as other material properties) by selecting the Material icon in the Meshing task. An element with a side that has a null emissivity does not emit or reflect thermal radiation from this side. An element with a side that has a null absorptivity does not absorb thermal radiation from this side. However, if this side of the element is included in a *Radiation Request*, it will block or "shadow" radiation in the model, resulting in incorrect view factors (the view factor sum will deviate from zero).

When creating radiation related modeling entities, use the *Reverse of* section of the form to select elements that radiate from their reverse side. You can pick *visible* and select the elements or pick the elements' *group*. Display the selected elements with the *Sketch* button.

Reverse Sides Entity

An alternate method for modeling optical properties and other characteristics of the reverse side of a 2-D element is to create a separate entity called a *Reverse Sides* entity. In this case you do not need to define reverse side optical properties when defining the material for the elements. The optical material properties specified on the *Reverse Sides* entity form override the corresponding material properties for the reverse side of the selected elements.

To model radiation from the reverse side of an element with a Reverse Sides entity, TMG creates a temporary companion element which faces in the opposite direction. This "Reverse Side" element is used to calculate view factors, radiative conductances, and radiative heat loads, and then is merged back into its parent element prior to model solution. This means that the parent and the reverse side elements share the same temperature (unless the *Create as Separate Elements* option is selected).

[Locate the icon.](#)

Material Properties

You can define the reverse side IR and solar properties independently, using one of several options for each.

- *Same as Front Side* specifies that IR or solar properties be the same as those previously defined (in the Meshing task) for the front side of the element
- *New Values* allow you to define IR or solar property values. For new IR values you must enter a value for emissivity; IR specular reflectivity is optional. For new Solar values you must enter a value for absorptivity; solar specular reflectivity is optional.
- *Not Active* defines the reverse side as having null IR or solar properties.
- *Use Material Values* specifies that IR or solar properties be the same as those previously defined (in the Meshing task) for the front and reverse sides of the element.

Create as Separate Elements

Using Reverse Sides entity, you can calculate a different temperature for the front side and the reverse side of an element.

The Create as Separate Elements option adds a new calculation point to the conductance matrix to account for the reverse side element. In this case, the temperatures are not merged back into one calculation point. The front and reverse side temperature can then behave independently.

However, to enable thermal exchanges between the front and the reverse side, you must create a thermal coupling between the element group and the Reverse Side entity. You can define the coupling in terms of a Heat Transfer Coefficient to model conduction, and/or in terms of an Effective Emissivity to model radiation.

Element Label Increment

The labels for the reverse side elements are assigned by incrementing the parent's label by a fixed value. You may specify this increment or enter a value of 0 to have TMG automatically assign an increment.

Selecting Reverse Side Elements

You can select reverse side elements in any TMG modeling entity but the method to select the *Reverse Sides* varies depending on the modeling entity.

In radiation related modeling entities, to select elements that radiate from their reverse side you pick the elements' *group* in the *Reverse of* field. If a *Reverse Sides* entity exists for the selected elements, TMG automatically uses it. By selecting the element group instead of the *Reverse Sides* entity, you can display the selected elements allowing you to check, for example, if your enclosure is effectively closed.

For the other modeling entities that use *Reverse Sides*, like *Thermal Couplings*, when you select either *Group* or *Visible*, you are selecting the front side of the elements. If you want to select the reverse side of the elements, you must create a *Reverse Sides* entity and select the entity with the *Reverse Sides* selection option.

Post Processing with Reverse Sides

You can post process element-based results data for reverse side elements. In the *Calculation Domain* form, select the *Shell Bottom* Surface option. If you want to display the average of the front and back side data values, select the *Middle* Surface option.

You can recover the following types of results for *Reverse Side* elements:

- temperatures
- convection coefficients
- view factor sums
- radiative fluxes
- solar, earth view factors

Notes on Reverse Sides

- Use element triads to display the front element sides.
- Normally, *Reverse Sides* are not used for elements that are surface coated onto 3D elements. Enabling radiation from the reverse side of surface coating elements (either with a Reverse Sides entity or with defined optical material properties) should be done only if the solid that is surface coated is transmissive. Solids are ignored by the radiation calculation, they cannot block radiation.

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