Setting Radiation Controls

Use *Radiation Control* to set up global control parameters for radiation simulations. For most models, you will not have to set any of these parameters: the default setup will provide good results. However, for particular modeling situations you may be able to improve accuracy or reduce solution time by specifying more appropriate settings.

You can set global parameters for the computation of black body view factors. You can also select the algorithm which TMG will use to compute radiative conductances, and select the treatment of residual view factors. You can also strip insignificant radiative conductances from the model to reduce solution time.

Locate the icon.

Calculation Method

TMG uses one of two algorithms to compute radiative conductances from black body view factors: Oppenheim's method or Gebhardt's method.

For a detailed explanation on how each method works with their respective advantages and disadvantages see *Radiative Coupling Calculation* under *Understanding TMG Radiation*.

Oppenheim's method yields an easier equation system to solve than Gebhardt's method and it can efficiently model temperature dependent emissivity, therefore it is the recommended calculation method.

Element Offset

With Oppenheim's method, TMG creates a non-geometric surface element for each radiating element of the model. TMG detects from the model which label these new elements should have but you can specify an offset. For example, you may want to specify an offset to easily find these elements in any TMG file.

Radiative Coupling Threshold

With Gebhardt's Method, TMG will calculate the gray body view factor matrix. This involves the inversion of the black body view factors matrix. This tends to produce a more "full" matrix with many additional radiative couplings.

You can reduce the number of radiative conductances in the model by entering a threshold value. TMG will identify and treat all radiative conductances whose gray body view factors are less than the specified value times the larger of the two gray body view factor of either element. You must select the *Disposition* of these small couplings: *Dispose* results in their removal, *Collect* connects them to the element specified to receive the residual view factors.

Generally a radiative coupling threshold of 0.05 will reduce solve time with minimal impact on accuracy.

Residual View Factors

Closure of the radiation problem requires that the black body view factors for each element sum to one. Because of numerical imprecision in computing shadowed view factors, this condition is generally not satisfied. The difference is called the *Residual View Factor*; its magnitude indicates the inaccuracy in the view factor calculations for that element. You can select the method which TMG uses to eliminate this residual.

- *Weighted Distribution* adjusts the computed view factors iteratively to bring the view factor sum for each element as close to one as possible. Only view factors computed with shadowing are adjusted. This is the recommended option for all models and is set as the default.

- *Self View* creates a view factor (equal to the residual) to the element itself. This is equivalent to making the element slightly concave or convex.

- *To Space* creates a view factor (equal to the residual) to the *Space Enclosure* entity.

Global Element Subdivision Parameter

The *Global Element Subdivision Parameter* is a global default for the element subdivision which TMG performs in computing shadowed view factors when using the Fixed Subdivision option on the *Radiation Request* form.

Setting Advanced Radiation Parameters

Stefan-Boltzmann Constant

The *Stefan-Boltzmann Constant* is used in computing radiative conductances; if you are using I-DEAS units its value is automatically defined. However, if you are using units not recognized by I-DEAS, you must enter the Stefan-Boltzmann constant in the appropriate units.

Minimum View Factor to Process

Prior to calculating a view factor, TMG estimates its value based on the elements' size and distance. If the estimated magnitude of the view factor is less than the specified *Minimum View Factor to Process*, TMG will not compute it. This value must be significantly less than the average view factor in the model; otherwise, important couplings will be lost.

Number of Axisymmetric Segments

Use *Axisymmetric Segments* to set the number of facets that TMG will use in revolving axisymmetric solid elements into 3-D elements, and axisymmetric surface elements into 2-D elements, for calculating radiative heat transfer. You must choose value of at least 8 facets. Normally no more than 12 segments are required. See the article on *Axisymmetric Modeling*.

Identifying Solver-Generated Reverse Elements

Reverse Element Label Increment applies only to elements with reverse side material properties (as opposed to Reverse Sides entities; see article *Front and Reverse Element Sides*). During the solve, TMG creates temporary elements on the reverse sides of these elements so this side can participate in radiative exchange. This option allows you to specify whether the TMG should automatically assign labels for these temporary elements, or instead use the value of the parent element label plus the specified increment. Knowing the increment can help to identify these elements when examining TMG solver files. See the TMG Reference Manual for more information on solver files.

Simplifying the Matrix by Merging Elements

Use Radiation Patches can significantly reduce solution time on very large models with complex radiative exchange. Use Radiation Patches temporarily merges adjacent elements for the purposes of calculating radiative exchange. After the calculation of view factors for individual elements, Oppenheim elements that are coplanar within a 15 degree tolerance are treated as a single element in the radiative exchange matrix.

Before merging elements, TMG performs several checks to ensure that merging is appropriate. In addition to being adjacent and coplanar within a tolerance, the elements must have identical radiative material properties, and must not be separated by any surface that intersects their surface (such as the two arms of a "T" intersection.)
