Sage Model Notes

RadCanEnclLong.scfn

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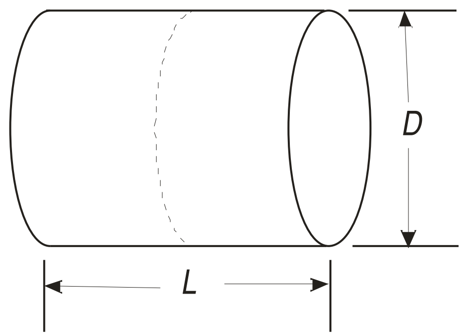
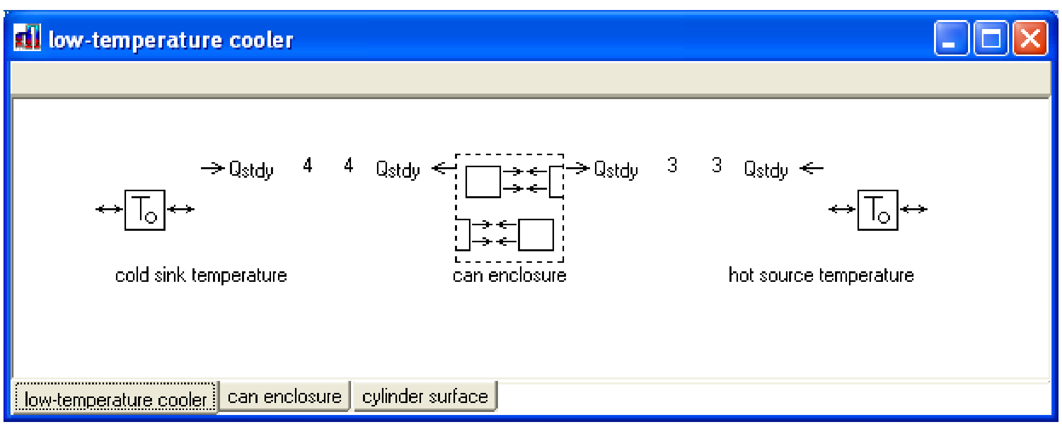
This is essentially the same as the model RadCanEncl.scfn (*see* RadCanEncl.pdf) except that the cylindrical surface is subdivided into two equal segments each with its own independent temperature in order to better resolve the temperature distribution along the wall. The physical geometry is the same, a radiation enclosure consisting of a the inner surface of a right circular cylinder exchanging heat with base and top surfaces:



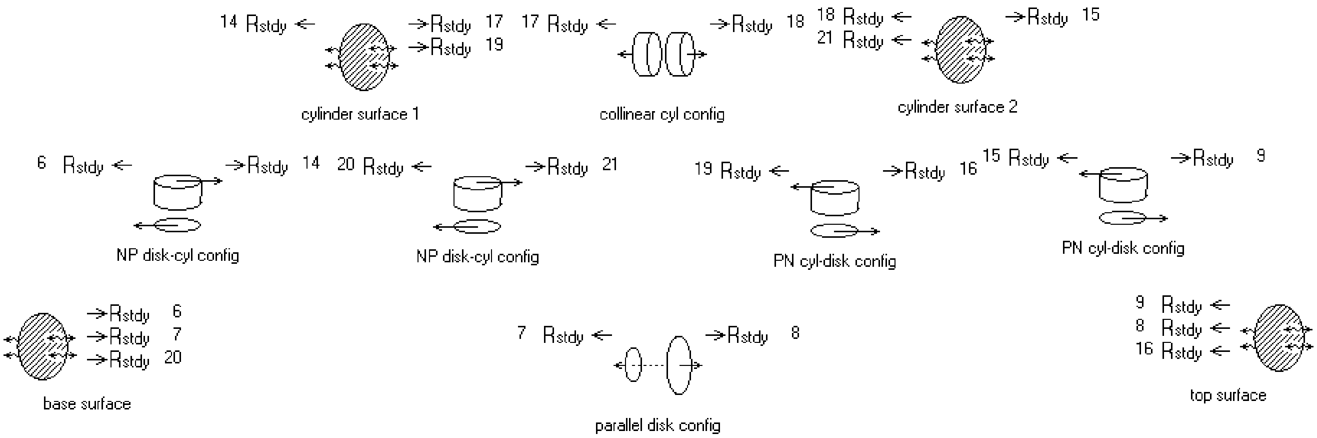
The base and top are anchored to external fixed temperatures. Of interest is the net radiation exchange between the base and top surfaces. The cylindrical surface is insulated from its surroundings and its temperature adjusts so that the net radiation heat transfer is zero.

The the top level Sage model is the same as before:



The *cold sink temperature* and *hot source temperature* anchor the two ends of the can (base and top) located within the *can enclosure* submodel.

The radiation exchange details within the *can enclosure* submodel are now more complicated. There are now two cylinder surfaces, making a total of four radiation surfaces in the enclosure. Each surface now requires three radiation interconnections compared to two previously:



There are now six view configurations compared to three previously.

Recast Variables

The same user-defined inputs at the can enclosure submodel level define the overall geometry and radiation properties of the enclosure:

Dcan	can diameter (m)	1.000E-02
Lcan	can length (m)	5.000E-02
EmCan	emissivity all surfaces (NonDim)	5.000E-01

As before the inputs for the view configuration components are recast in terms of the above:

base surface **and** ***top surface***
A = 0.25 * Pi * Sqr(Dcan)
Emiss = EmCan

cylinder surface 1 and 2
A = 0.5 * Pi * Dcan * Lcan
Emiss = EmCan

disk-cyl configs (connection base to cylinder surface 2 and top to cylinder surface 1)
Sepr = 0.5 * Lcan

parallel disk config
Sepr = Lcan

collinear cyl config
Dcyl = Dcan

Net Radiation transfer

Now the net radiation transfer between the can top and base is:

Rad	net incoming radiation flow (W)	7.450E-03

For the previous case where the cylinder surface was modeled in one piece it was 9.06 mW, or 22% higher. So depending on accuracy required the increased model complexity may be worth it. Especially for relatively long cans (compared to diameter) where the benefits of a refined cylinder wall model are more pronounced.

Higher Refinements

It is possible to subdivide the cylinder surface into three or more pieces following this example. However the number of radiation interconnections and view configuration components to support them grows roughly with the square of the number of surfaces in the enclosure model.

For each of N surfaces there are (N-1) radiation interconnections to the other surfaces requiring a total of N(N-1)/2 view configuration components (each view configuration serves a pair of radiation connections. For the current case N=4 and there are 6 view configuration components. Subdividing the cylinder into 3 pieces would increase N by one and require 10 view configuration components. A 4 piece cylinder would require 15.