Sage Model Notes

HeatExchanger-PwallToInternalFins.scfn

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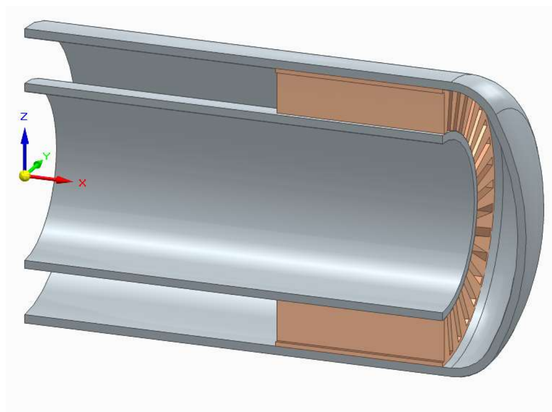
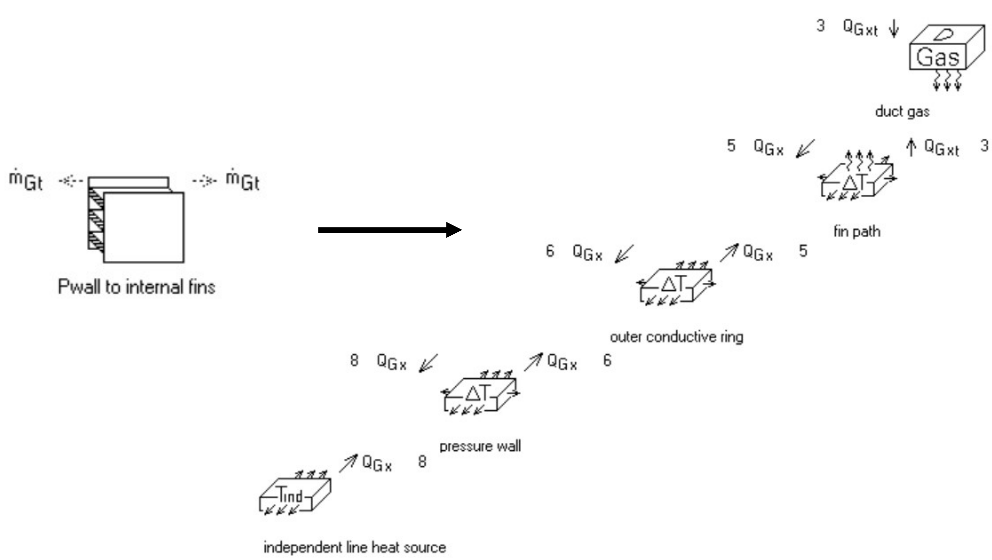
11 December 2024

An externally heated (cooled) pressure wall with annular copper block thermally bonded to a pressure wall ID. Radial fins cut in inner part of copper block form gas channels. Heat transfer through pressure wall, to copper block, then to gas flowing through channels.



More-or-less following the above rendering, the Sage model consists of a *rectangular fins* component renamed *Pwall to internal fins*, inside of which are two *distributed conductors* renamed *pressure wall* and *outer conductive ring and* a *conductive surface* renamed *fin path*. An *independent line heat source* anchors the pressure wall outer temperature:



Root level user-defined inputs define the fin envelope.

IDpwall	pressure wall ID (m)	3.300E-02
IDfins	fin tip ID (m)	2.200E-02

```
  ODfins          fin base diameter (m)                     3.300E-02
```

These will not come along for the ride if you copy and paste the *Pwall to internal fins* component into another model, so you will have to re-create them there or copy-and-paste them between models using two instances of the *Explore User-Customized Variables* dialog (Tools | Explore User Variables), using the Window's clipboard.

The *Pwall to internal fins* component defines the number of fins and the width of the gas channels (gap between fins) with built-in inputs `Nchan` and `Wchan`. Other inputs are recast according to the overall geometry:

```
Recasts
  Hchan = 0.5*(ODfins - IDfins)
  Tfin = Ametal / (Nchan * Hchan)

Outputs
  Aenvelope        total cross section fin part             3.746E-04
    Pi/4 * (Sqr(ODfins) - Sqr(IDfins))
  Ametal           required solid cross section             2.126E-04
    Aenvelope - Aflow
```

The pressure wall defines the wall thickness with built-in input `D` and circumference by recasting the `W` input as

```
  W = Pi * IDpwall
```

If this puzzles you see the documentation for model HeatExchangers-ThermalConductors.scfn for more information.

The outer conductive ring is the outer ring of fin material not cut through by the channels. It recasts wall conduction thickness and circumference inputs as

```
  W = Pi * IDpwall
  D = 0.5*(IDpwall - ODfins)
```

The fin path recasts its fin conduction length input to

D = 0.5*(ODfins - IDfins)

This is sufficiently accurate for efficient fins. Where fin efficiency is low the Sage model tends to be conservative by under-predicting the heat transfer for a given temperature difference between gas and fin base. Essentially the Sage model forces all the heat to pass through half the fin conduction length. See the documentation for model HeatExchangers-SimpleIsothermal.scfn, Rectangular Fins section for details.