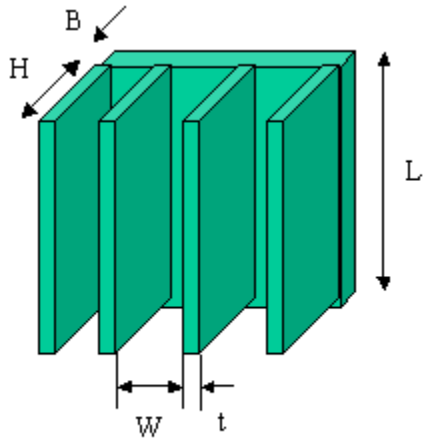
Estimating Radiation Heat Transfer from an Extruded Heat Sink

In natural convection situations where the convective heat transfer coefficient is relatively low, radiation can have a significant contribution to the overall heat transfer from an extruded heat sink. The following calculation routine is derived from " Thermal Radiation from Finned Heat Sinks, Samuel Rea and S.E. West"

The heat sink considered is shown in the figure below:



Extruded Heat Sink Configuration

The radiation heat transfer from all surfaces of this heat sink can be calculated using the formulation shown below:

$$Q = \left\{ \left(N_f - 1 \right) \varepsilon_a W + \varepsilon \left[N_f t + 2(H + B) \right] \right\} L \sigma (T_s^4 - T_A^4)$$

where:

N_f is the number of fins,

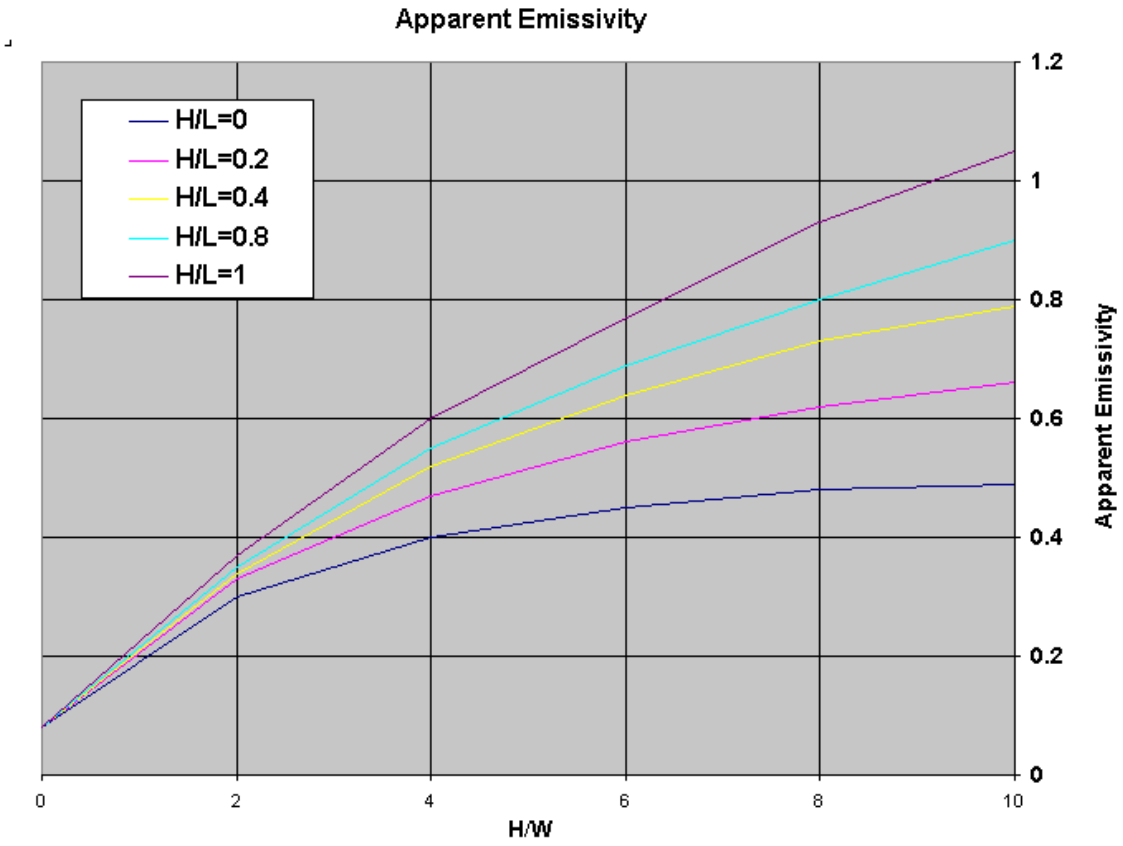
ε_a is the apparent emissivity of a channel,

T_s is the heat sink surface temperature and,

T_A is the ambient temperature

The apparent emissivity is a function of heat sink dimensions and surface emittances of the sink material. It can be computed using the enclosure theory assuming a diffuse gray surface and constant surface temperature. The results are depicted in the following graphs for two values of the surface emissivity

This graph is for emissivity of 0.08:



And this graph is for emissivity of 0.8: