Given
A HZ 20W thermopile

Find
Necessary heat transfer for optimum power output

Solution

$k_{pile} := 0.024 \frac{W}{cm \cdot K}$

$t_{pile} := 0.508 cm$

$T_{hot} := 230 °C$

$T_{cold} := 30 °C$

$\Delta T_{\pi} := 200 K$

$l := 7.5 cm$

$A := l^2$

$Q_{\pi} := k_{pile} \cdot A \cdot \frac{T_{hot} - T_{cold}}{t_{pile}}$

$Q_{\pi} = 531.5 W$

Given
Necessary heat transfer

Find
Heat transfer coefficient and heat fin area

Solution

According to the following website, a smokestack for a schrader wood stove reaches temperatures between 300-400 degrees. No units were provided but the author is from Missouri, so I'll assume Fahrenheit.

http://www.tractorbynet.com/forums/rural-living/73614-woodstove-pipe-temperature.html

$n := 100$ $A_0 := 16in^2$

$i := 1 .. n$ $A_f := 10000cm^2$

$$Area_i := A_0 + i \cdot \frac{A_f - A_0}{n}$$

$M := 100$ $Th_0 := 300\,°F$

$j := 1 .. M$ $Th_f := 400\,°F$

$$Tsmoke_j := Th_0 + j \cdot \frac{Th_f - Th_0}{M}$$

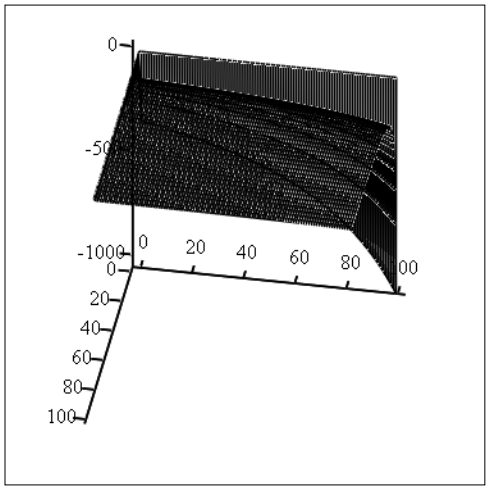
$o := 100$ $Tc_0 := -40\,°C$

$k := 1 .. o$ $Tc_f := 70\,°F$

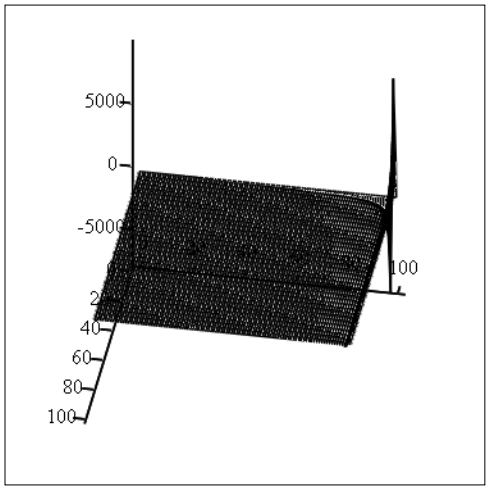
$$Tair_k := Tc_0 + o \cdot \frac{Tc_f - Tc_0}{k}$$

$$hsmoke_{i,j} := \frac{Q_\pi}{Area_i \cdot \left(Tsmoke_j - T_{hot}\right)}$$

$$hair_{i,k} := \frac{Q_\pi}{Area_i \cdot \left(T_{cold} - Tair_k\right)}$$



hsmoke



hair