ENPH 257 Assignment 2

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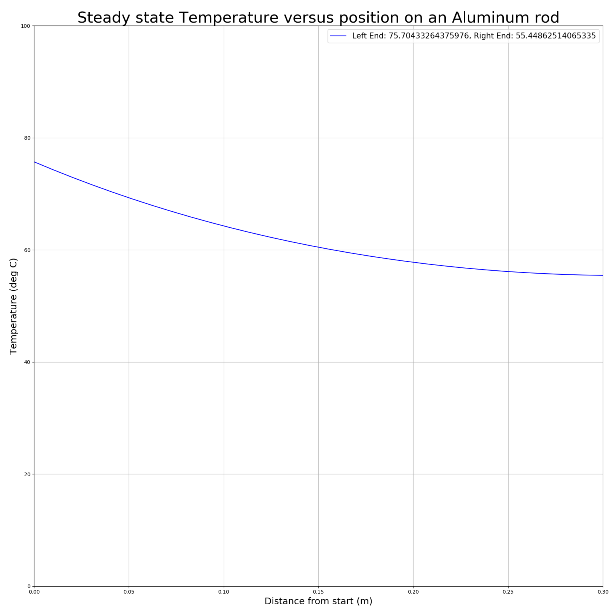
1 A1

Figure 1: Steady State for Temperature of an Aluminum Rod of diameter 2cm painted matt, black which is exposed to 10 W of thermal power on the left end. An ambient Temperature of $20\,^{\circ}\mathrm{C}$ and a convection constant of $5\,\mathrm{W} \cdot \mathrm{K}^{-1} \cdot \mathrm{m}^{-2}$



2 A2

Doing a little bit of research, I was able to find some information on the convection constant of an Aluminum rod using this link: `http://www.phas.ubc.ca/~phys209/files/convectionrods.pdf`. What I found was the convection constant k is related to the temperature using the following equation:

$$k = 1.32(\frac{(T - T_0)}{d})^{1/4} \tag{1}$$

Where T is the temperature of the rod, d is the diameter and T_0 is the ambient temperature. Using this equation we can calculate the convection constant for all the slices of the rod. Using (1) and assuming an initial T of $50\,°C$ ($323.15\,K$) and a value of $20\,°C$ ($293.15\,K$) for T_0 and $0.02\,m$ for d, we get about $8.21\,W \cdot K^{-1} \cdot m^{-2}$.

3 A3

Figure 2: A PV graph of a Brayton Cycle for an isotropic pressure ratio of 15 with an ambient Temperature of 20 °C and a maximum Temperature of 1000 °C. The Red and blue lines are the Adiabatic paths while the green and black are the two Isobar paths.

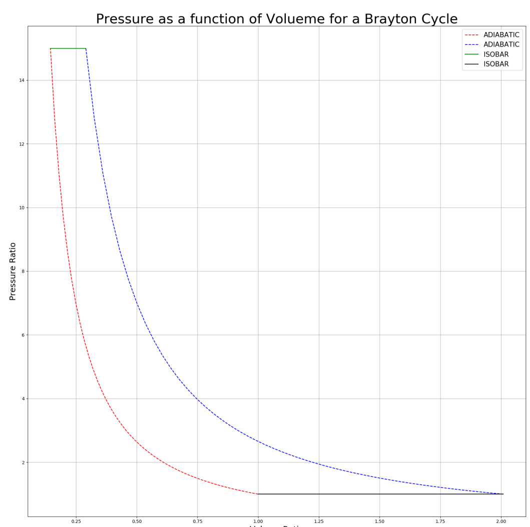


Figure 3: Efficiency as a function of Pressure ratio for a Brayton Cycle. The red dots shows the calculations of efficiency using the area of the PV plot and the temperature differences, while the blue line identifies the theoretical plot of the efficiency.