

Problem 3.156

You have obtained the correct temperature profile

$$T(x) = \frac{qL^2}{2k} \left(1 - \frac{x^2}{L^2} \right) + \frac{T_{s2} - T_{s1}}{2} \frac{x}{L} + \frac{T_{s2} + T_{s1}}{2}$$

and apply boundary conditions to get T_{s1} and T_{s2} . BC's are by equating conduction and convection on each surface. Differentiate the temperature distribution above and apply at each surface to get the BC.

On the fin side, the total heat transfer rate can be calculated by using the overall fin array efficiency η_o along with fin efficiency η_f .

With the two BC's, you have 2 equations and 2 unknowns T_{s1} and T_{s2} which can be solved. (The solution is a bit long and ugly. If you want to do it using Mathcad or Mathematica please do so).

So, with the known T_{s1} and T_{s2} , you can differentiate the temperature distribution and get T_{max} as we discussed after class. Basically our discussion was on the right track.