

CHEN 3650 SP12 - Course Extra Credit Problem

Dueling Fins

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1 Problem Statement

Consider the double fin geometry indicated in Fig. 1. The fins extend infinitely out of the page, and have a variable cross sectional area (in the x direction). The fins convect to the ambient (at T_a) on their upper and lower surfaces and are made of two different materials. You may neglect gradients in the y direction. Assume that T_a is 25 °C. The analytical solution to the differential equations that describe the steady state temperature profiles in this problem involves complex modified Bessel functions, and you are not expected to solve analytically. However, you are expected to be able to qualitatively describe the system and quantitatively solve for the steady state temperature distribution using numerical methods.

You should work in the non-dimensional form of equations and re-dimension your results at the end. Your model must take at least five inputs that are: the two Biot numbers (Bi_n), the aspect ratio ($AR = L/B$), and the two wall temperatures (input in °C, $T_{w,n}$). Your model must be able to return the temperature (not the non-dimensional temperature) and dimensionless heat flux (you can not compute the heat flux in terms of dimensioned quantities) at the following dimensionless x locations: $x = 0$, $x = -0.5$, and $x = 0.5$. Also a plot of the temperature profile and the tabulated data that was used to plot the temperature profile is required.

These instructions may be modified as needed for clarification.

2 Requirements for Submission

You are to hand in a *brief* report on your model and solution, explaining your model equations and solution routine. Also be sure to explain how to operate your model. **An electronic form of your working model is required to get any credit at all.** Set your model initially to the following vector of inputs: $\{Bi_1, Bi_2, AR, T_{w,1}, T_{w,2}\} = \{2, 0.2, 3, 200, 150\}$. Report the requested information from the problem statement.

3 Grading Information

Your numerical solution will be compared to the analytic solution. Accuracy is worth 60% of the extra credit. The balance credit is earned from the description of the approach and model. This is to be individual work. No “group efforts” are allowed.

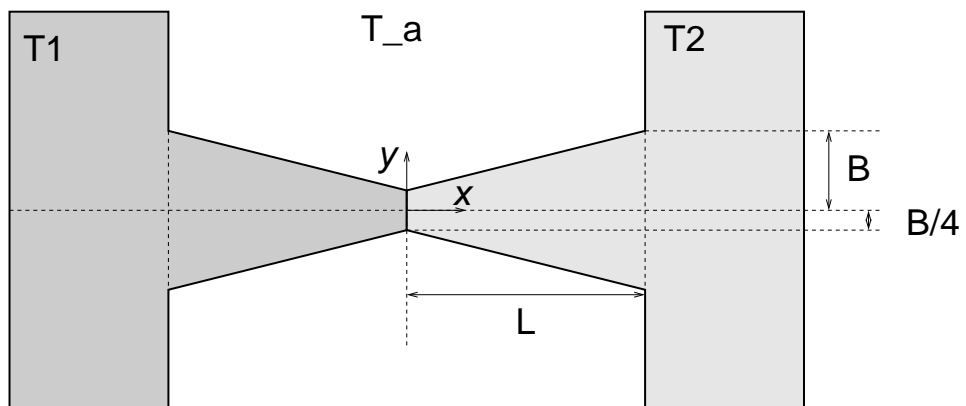


Figure 1: Diagram of geometry for the dueling fins problem.