E136800: Computer Project - Spring 2014

Instructor: Dr. Yu-Bin Chen

List of team members due: May 21, 2014 (Wednesday)

Report due: June 17, 2014 (Tuesday)

Figure 1 shows a cross sectional view of metallic periodic fins. Boundary conditions and dimensions of fins are also specified. Your team is asked to calculate the temperature distribution $T(x, y)$ at the steady state using the finite-difference method. The side length of a mesh is set as 2 cm at the begining. The output of results includes a clear figure, which is similar to the example given in Fig. 2. The figure should contain isotherms (contour background) and heat flux vectors (arrowheads). In addition to the figure, your report should also contain answers to following questions.

1. What are q (one fin and base heat transfer rate), q_f (one fin heat transfer rate), ε_f (fin effectiveness), ε_e (fin efficiency)? What is the *T* of every node?

2. What will answers change if the mesh size shrinks to 2×1 cm and 1×2 cm ?

3. Which mesh above works better? Explain the reason and provide convincing proofs or validation of results.

A report must include following sections to receive full credits:

(1) Statement of the problem;

(2) Differential equations and boundary conditions if you were to use the analytical method;

(3) Finite difference scheme, nodal equations, and solution method;

(4) Results with plots, discussion, and validation;

(5) Appendix – text of the computer codes.

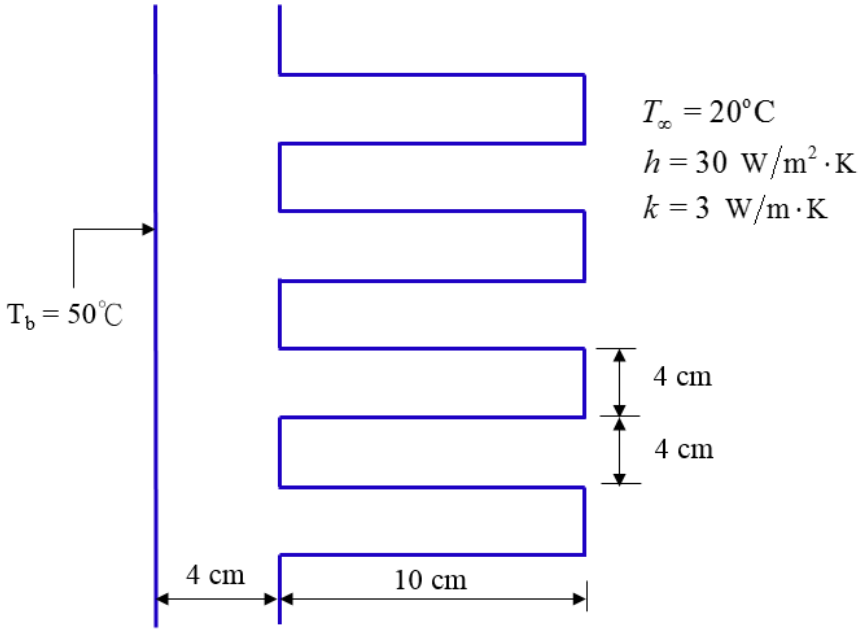

Figure 1 Cross sectional view of periodic fins. The right-hand side is merged into a fluid at T_∞ = 20°C, but the left side is in contact with a base of constant temperature T_b = 50°C.

Example

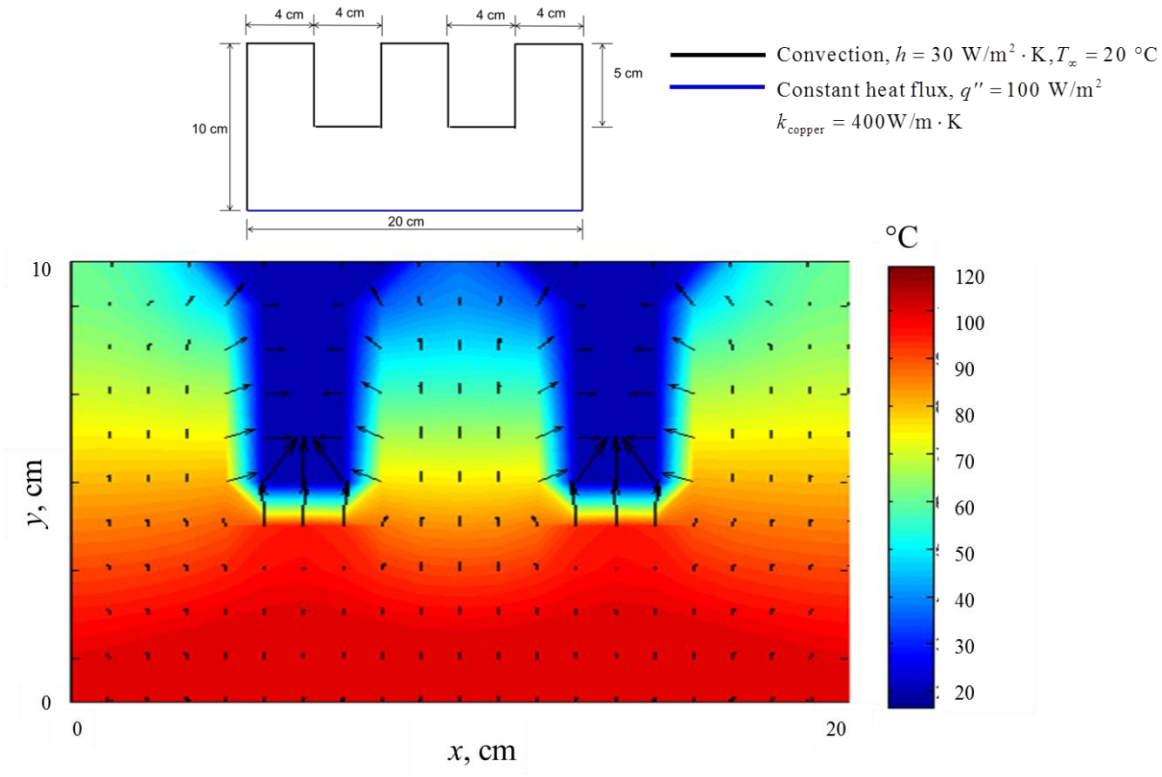

Figure 2 An example of figure showing isothermal lines as the contour background and heat flux vectors as arrowheads. The original problem is specified above for reference as well.

You need plot the “temperature distributed and heat flow direction around the fin”.