MA402, Homework #2
**Due Thursday, September 20, 2001**

1. Consider the explicit finite difference model for the heat transfer in a thin rod, *which may have heat loss on the lateral surface*. See Chapter 1.2 and 1.3 for details.

   (a) Modify the algorithm and the code *heat.m* (can be downloaded from the class web-page: http://www4.ncsu.edu/~zhilin/TEACHING/MA402/index.html) to implement the discrete model that includes the heat loss on the lateral surface.

   (b) Modify the algorithm and the code *heat.m* to allow non-homogeneous boundary condition, that is, $u(0,t) = g_1(t)$ and $u(L,t) = g_2(t)$, where $g_1(t)$ and $g_2(t)$ are two functions. You are asked to use Matlab function to define $g_1(t)$ and $g_2(t)$. Take $g_1(t) = \sin t$, $g_2(t) = e^{-t}$, and $t_{final} = 100$.

   (c) Duplicate some of the calculations in Chapter 1.3, i.e. with different $c_{sur}$ and explain your results. Do your results look reasonable (answer this question by inspecting the boundary conditions, the steady state solutions etc.)? Find an approximate stability condition. How is it different from that in Chapter 1.2 ($c_{sur} = 0$)?

   (d) Experiment with different values of $c$ ( the specific heat) with $c_{sur} = 0.0005$ fixed. What happens to the numerical solution as $c$ increases/decreases?

   **The number of plots should be between three to six. You need to label all your plots. Put also a title for each plot.**

   Your homework report should be organized as the following:

   (a) A suitable title of your imagination.

   (b) You printed name and student ID.

   (c) The algorithm description.

   (d) Your itemized experimental results, analysis/explanations, which can include tables and plots.

   (e) A brief summary if necessary.

   (f) Your computer code as an appendix.