Computational Fluid Dynamics (AE/ME 339)
MAEEM Dept., UMR, Fall 2003

Home Work Problem 06b

A circular steel rod of length L = 30 cm, insulated on the sides, is initially at a temperature of 0^o C. Suddenly the right end is raised to a temperature of 50^o C and maintained at that temperature, while the left end is kept insulated. Use the implicit method discussed in class, and calculate the temperature distribution along the length of the rod at the following non-dimensional times. Solve the equations in the non-dimensional form given below.

$$\theta = \frac{T - T_0}{T_1 - T_0}, \quad \tau = \frac{\alpha t}{L^2}, \quad \xi = \frac{x}{L}$$

i) 0.05
ii) 0.1
iii) 0.15
iv) 0.35

1. Plot your results in non-dimensional form using $\theta = (T-T_o)/(T_1-T_o)$, where T_o is the initial temperature and T_1 is the temperature at the right end for $\tau > 0$.
2. Form a table of values of the temperature distribution for case (i) for 20 intervals (21 nodes) and $\lambda = 0.4$.
3. Check for grid independence of your solution.