Home Work Problem 6

An infinitely long bar of thermal diffusivity $\alpha$ has a square cross section of side 2a. It is initially at a uniform temperature $T_0$ and then suddenly has its $x = 0$ and $x = 2a$ surfaces raised to a temperature $T_1$, and the $y = 0$ and $y = 2a$ surfaces raised to temperature $T_2$. These surface temperatures are held constant at those values subsequently. Compute the temperature distribution $T(x,y,t)$ inside the bar using the ADI method.

1. Obtain numerical solutions for the following data: $\alpha = 1.3 \times 10^{-5} \text{ m}^2/\text{s}$, $a = 20 \text{ cm}$, $T_0 = 20^\circ \text{C}$, $T_1 = 80^\circ \text{C}$, $T_2 = 60^\circ \text{C}$.

2. Plot the dimensional temperature distribution along a line AB parallel to x axis for which $y = 10 \text{ cm}$, for time $t = 610 \text{ s}$, $1200 \text{ s}$ and $2300 \text{ s}$. Include printed output for temperature distribution in the planes of symmetry for $t = 610 \text{ s}$.

3. Present your results and discuss the solution. Your submission should include a brief description of the problem, program listing, the solution technique, convergence, and accuracy.