

Computational Fluid Dynamics (AE/ME 339)
MAE Dept.

Home Work Problem 08

An infinitely long bar of thermal diffusivity α 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: $\alpha = 1.3 \times 10^{-5} \text{ m}^2/\text{s}$, $a = 20 \text{ cm}$, $T_0 = 20\text{C}$, $T_1 = 80\text{C}$, $T_2 = 60\text{C}$.
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 s and 2300 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.

