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

Home Work Problem 6a

An infinitely long bar of thermal diffusivity α has a square cross section of side 2a. It is initially at a uniform temperature θ_0 and then suddenly has its x = $\pm a$ surfaces raised to a non-dimensional temperature θ_1, and the y = $\pm a$ surfaces raised to non-dimensional temperature θ_2. These surface temperatures are held constant at those values subsequently. The governing equations in non-dimensional form is given by

$$\frac{\partial\theta}{\partial\tau} = \frac{\partial^2\theta}{\partial\xi^2} + \frac{\partial^2\theta}{\partial\eta^2} \tag{1}$$

Set up the procedure using one fourth of the domain and symmetry conditions. Use the symmetry conditions derived in class for the insulated boundary, where the adjacent node temperatures are **not** assumed to be equal. Write a procedure outline for numerically solving the problem, showing the equations for the boundaries and the interior points. Calculate the coefficients for the equations using $\Delta\xi = \Delta\eta = 0.05$ and $\Delta\tau = 0.01$ Your answer should be in the matrix form. Explain all symbols used.