

Computer Assignment 2

ME 543 Computational Fluid dynamics

Submitted by

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Table 1: Discretised Equations

FTCS	$T_{i,j}^{n+1} = T_{i,j}^n + \gamma_x \delta_x^2 T_{i,j}^n + \gamma_y \delta_y^2 T_{i,j}^n$
BTCS	$\gamma_y T_{i,j-1}^{n+1} + \gamma_x T_{i-1,j}^{n+1} - (1 + 2\gamma_y + 2\gamma_x) T_{i,j}^{n+1} + \gamma_x T_{i+1,j}^{n+1} + \gamma_y T_{i,j+1}^{n+1} = -T_{i,j}^n$
ADI	<p>X sweep: $\frac{\gamma_x}{2} T_{i-1,j}^{n+1} - (1 + \gamma_x) T_{i,j}^{n+1/2} + \frac{\gamma_x}{2} T_{i+1,j}^{n+1} = -T_{i,j}^n - \frac{\delta_y^2 T_{i,j}^n}{(\Delta y)^2}$</p> <p>Y sweep: $\frac{\gamma_y}{2} T_{i,j-1}^{n+1} - (1 + \gamma_y) T_{i,j}^{n+1} + \frac{\gamma_y}{2} T_{i,j+1}^{n+1} = -T_{i,j}^{n+1/2} - \frac{\delta_x^2 T_{i,j}^{n+1/2}}{(\Delta x)^2}$</p>

Table 2: Comparison of results

		Copper	Iron
FTCS	Time till Convergence	7530	8108
	CPU execution Time	3	2
ADI	Time till Convergence	6761	5075
	CPU execution Time	2	5
BTCS	Time till Convergence	6645	5574
	CPU execution Time	164	87

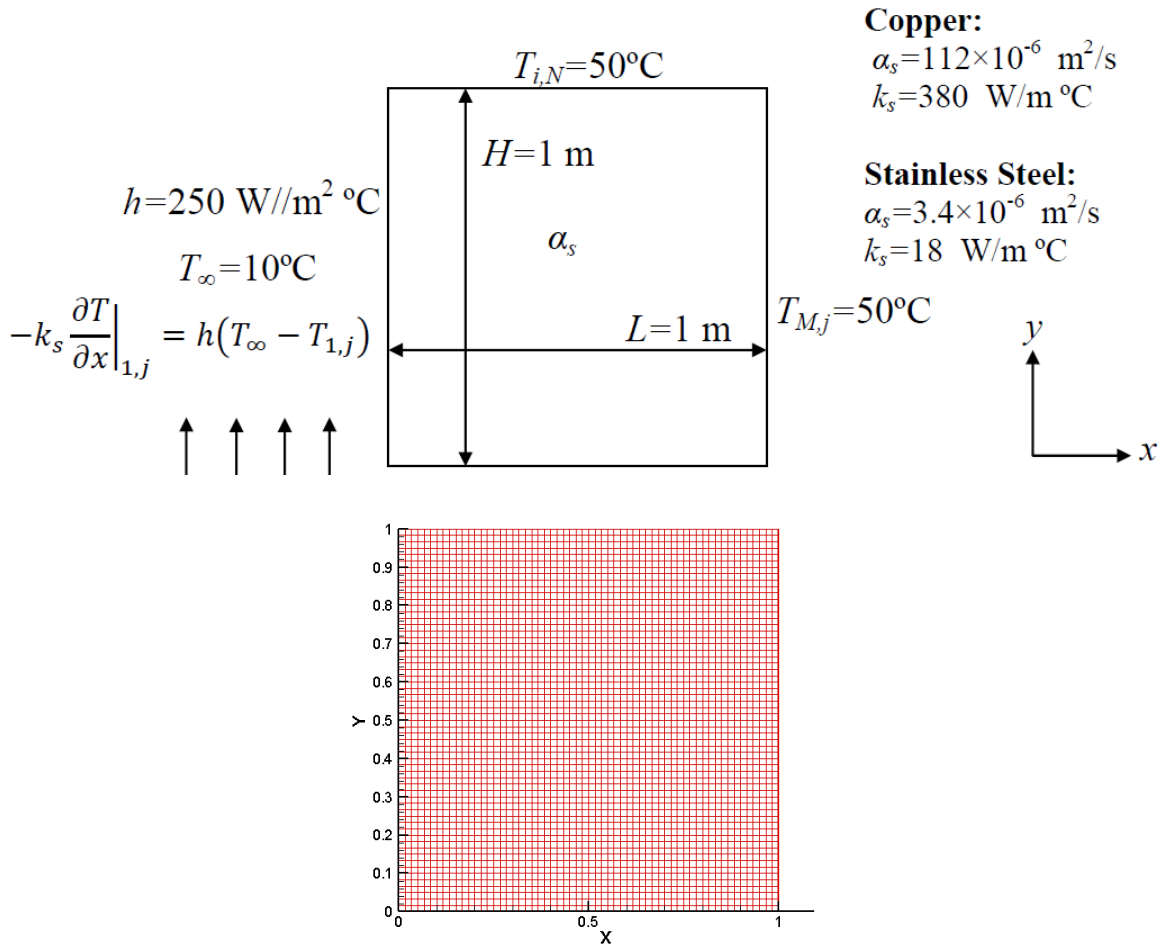


Fig: Discretised Domain with Problem Definition

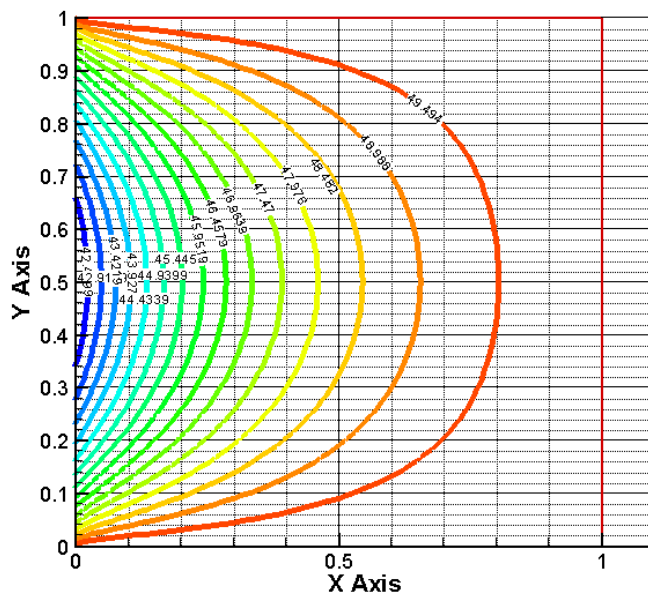


Fig: 1 Temperature Contour for Copper

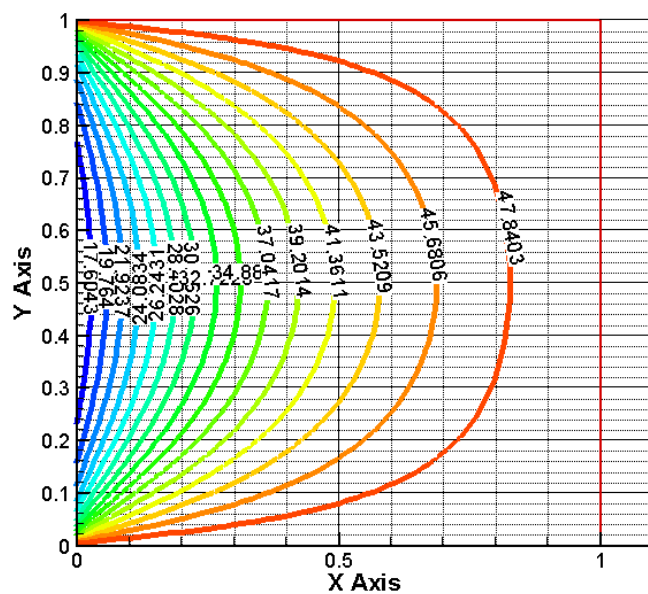
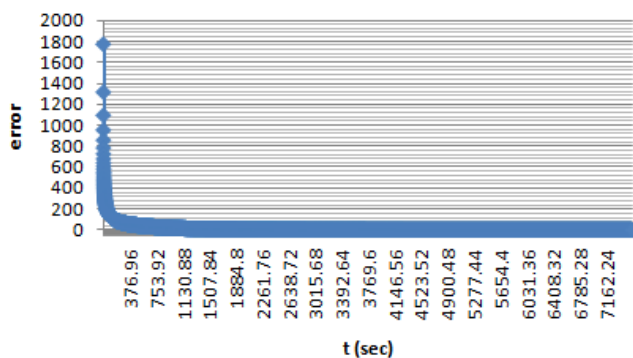
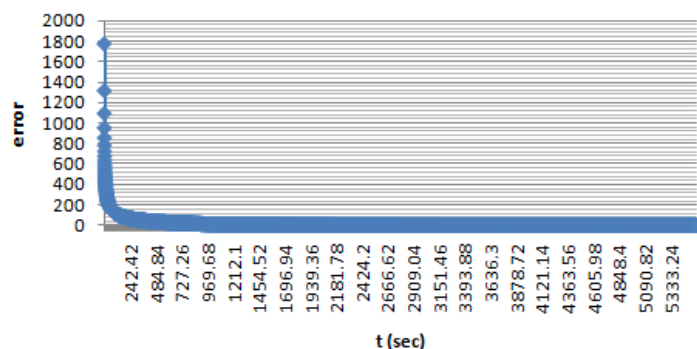


Fig: 2 Temperature Contour for Iron

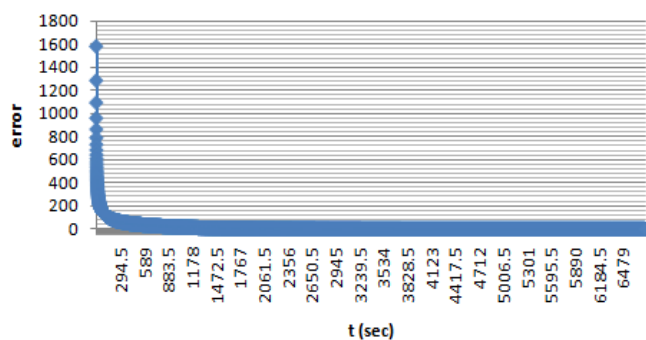
Convergence History for FTCS



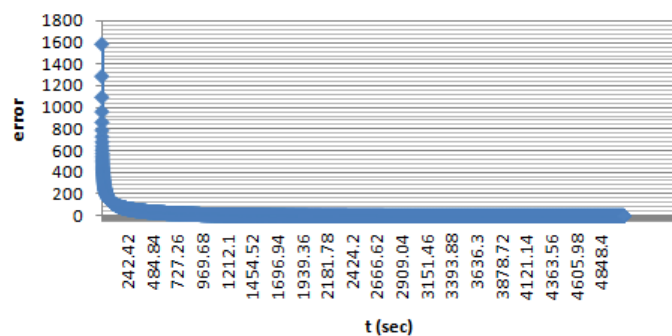
Convergence History for FTCS



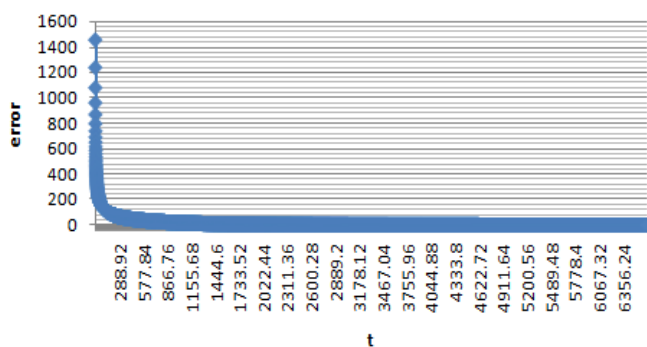
Convergence history for ADI



Convergence History for ADI



Convergence History for BTCS



Convergence history for BTCS

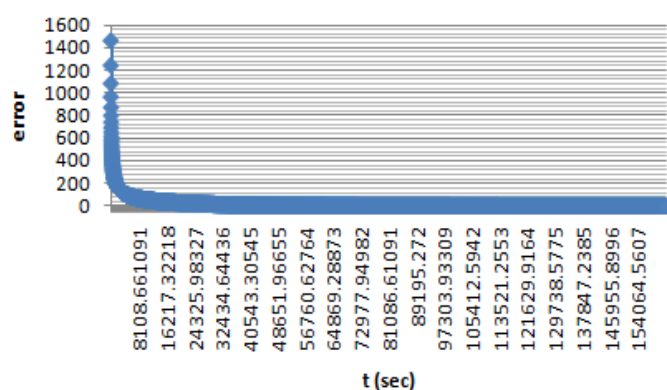


Fig: 2 Convergence histories for all the three methods for Copper

Fig: 4 Convergence histories for all the three methods for Iron