VIT AP

Numerical Methods for Engineers [MAT2001 - 136]

Marks: 50 **Duration: 90 mins.**

NM2-MAT2001

Answer all the questions.

1) The current flowing in a circuit is describe by $\frac{1}{2}\frac{di}{dt}+10i=12$. Assuming that that the initial current is zero, find the current flowing in the circuit at $i(0.2)$ using Piccard's method. Compare the numerical result obtained with the exact solution. (15 Marks) (15)

2) The concentration of a chemical in a batch reactor can be modeled by the differential equation: $\frac{dC}{dt}=\frac{-k_1C}{1+k_2C}$. Given that $C(0)=1$, $k_1=2$, $k_2=0.1$ find $C(0.2)$ using Runge - Kutta fourth order method. (15 Marks) (15)

3) Use the explicit method to solve the heat conduction equation $kT_{xx}=T_t$ for the temperature distribution of the long, thin rod. The rod is of length 10 cm. At t = 0. The temperature of the rod is zero and the boundary conditions are fixed for all times at $T(0) = 100^\circ C$ and $T(10) = 50^\circ C$. Note that the rod is aluminum with C = 0.2174 cal/(g .$^\circ$C) and $\rho = 2.7 g/cm^3$ and $k' = 0.49$ cal/(s.cm.$^\circ$C). Perform the numerical calculations for $\Delta x = 2$ cm, and $\Delta t = 0.1$s. (Hint: $k = k'/\rho C = 0.49/(2.7 \bullet 0.2174)$ $= 0.835\ cm^2/s$ and $\lambda = k\Delta t/(\Delta x)^2 = 0.835(0.1)/(2)^2 = 0.020875$). (20 Marks) (20)

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