Exam of Computational Physics
27-07-2018

Solve the following differential equation:

$$\frac{d^2y}{dt^2} - \frac{2\omega}{2\omega t + 1}\frac{dy}{dt} + (2\omega t + 1)^2 y = 0$$

in the time interval $t \in [0, 5]$, for the values of $\omega = 1, 2, 3, 4, 5$, by using a second order Runge-Kutta time scheme and the following initial conditions:

$$y(t = 0) = 1; \qquad y'(t = 0) = 0$$

and compare the result with the analytical solution:

$$y = \cos(\omega t^2 + t)$$

Verify that the numerical error (namely the difference in absolute value between the numerical and analytical solutions) for a fixed time step h, is proportional to ω^3.