

1) A stiff equation is a differential equation for which certain numerical methods for solving the equation are numerically unstable, unless the step size is taken to be extremely small. Use ode45, ode15s and ode23s solvers to solve the given stiff ODE in the interval [0, 5000].

$$y'(t) = -100 y(t) + 100 t + 1, \quad y(0) = 1$$

Plot all the solutions in one figure. Use appropriate legend for each solution and put your name on the title.

2) Use ode 45 and ode15s solvers to solve the following set of equations in the interval of [0, 3000]. Plot all the solutions in one figure. Use appropriate legend for each solution and put your name on the title.

$$y'_1 = y_2 \quad y_1(0) = 2$$

$$y'_2 = 1000(1 - y_1^2)y_2 - y_1 \quad y_2(0) = 0$$

3) A simple pendulum is a point mass at the end of a weightless rod of length L supported by a frictionless pin. The equation of motion of pendulum in a vertical plane is

$$\theta'' = - (g/L) \sin \theta$$

where  $\theta$  is the angular position of the rod and is measured with respect to vertical line. Solve the pendulum equation of motion in the time interval of [0 20] with the following initial conditions:

$$\theta(0) = \pi, \theta'(0) = 0$$

Use “**odeplot**” command to plot  $\theta(t)$  and  $\theta'(t)$ . Use appropriate legend and put your name on the title. Assume  $L=0.3$  m and  $g=9.81$  m/s<sup>2</sup>.