

Department of Mechanical Engineering
Indian Institute of Technology Madras
ME 5233 Multi-body Dynamics & Applications
Assignment 3

Due on: **October 27, 2023**

1. A single-degree-of-freedom vibrating system can be represented by the equation $\ddot{x} + 2\xi\omega_n\dot{x} + \omega_n^2x = 0$. The parameters are given by $\xi = 0.05$ and $\omega_n = 10$ rad/s with initial conditions $x(0) = 0.002$ and $\dot{x}(0) = 0$. Convert the second order equation to state-space form and then numerically integrate from $t = 0$ to $t = 3.2$ s.
 - (a) Euler's method (1st order)
 - (b) Adams-Bashforth method (2nd order)

For all the above cases run with h or $\Delta t = 0.1$ s, 0.04 s and 0.008 s. Compare the results with the exact solution (see any standard vibration text book) and comment on your answers. You can write the integration code in MATLAB or any other language but **do not use** the standard functions in MATLAB available for numerical integration.