Homework 2 Due: 12:00 27 May 2022

Problem 1

Consider the <u>velocity function</u> on the interval $t \in [0, 4]$,

$$v(t) = \exp(-0.1t)\cos(5t) + (t^2 - 0.1t^4).$$

(a) Using $\Delta t = 0.01$, compute <u>the displacement traveled over the time interval</u> by computing the <u>integral</u> as a function of time. Writing your own codes to use a left-sided rule, a right-sided rule, and a trapezoidal rule to compute the displacement. And, <u>try learning MATLAB built-in function to use a Simpson's rule to compute the displacement.</u>

(b) Compute the <u>acceleration</u> by <u>numerically computing the derivative of the velocity using the center differencing.</u> Note that for the two end-points you may have to use forward or backward differencing. And plot the curves of $v(t)$ and the acceleration in a figure, and attach it in your report (Note: remember to add the x- and y-axis labels and the legend in your plot).

(c) The <u>derivative of acceleration</u> is called the jerk. Please derive the <u>mathematical formula</u> in your report for computing the jerk from $v(t)$ (Hint: starting with the <u>Taylor expansion formula).</u> And <u>implement your algorithm</u> in MATLAB to compute the jerk.