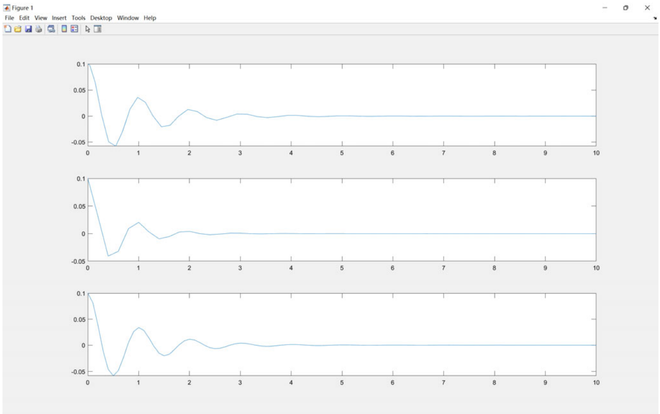
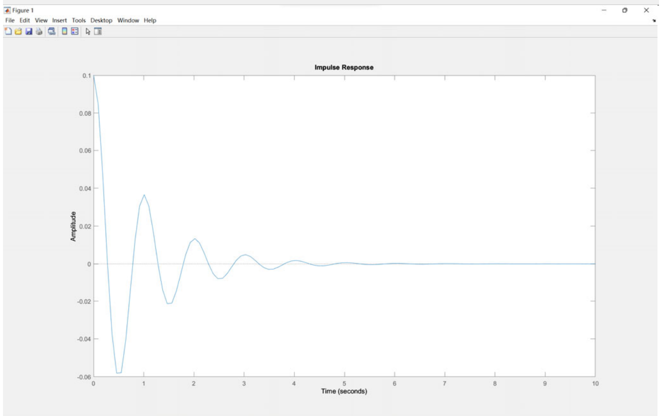
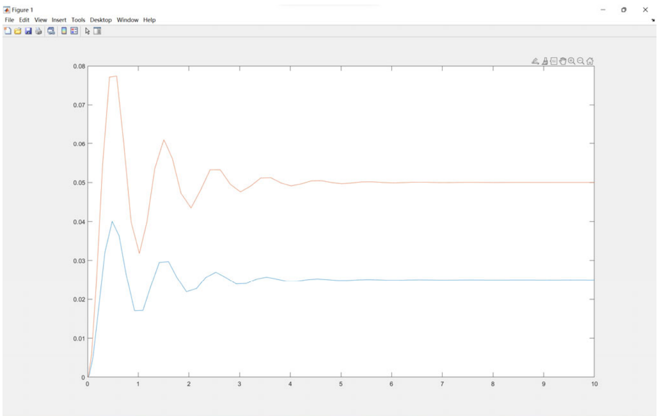
Lab 2 lab

Q1.a

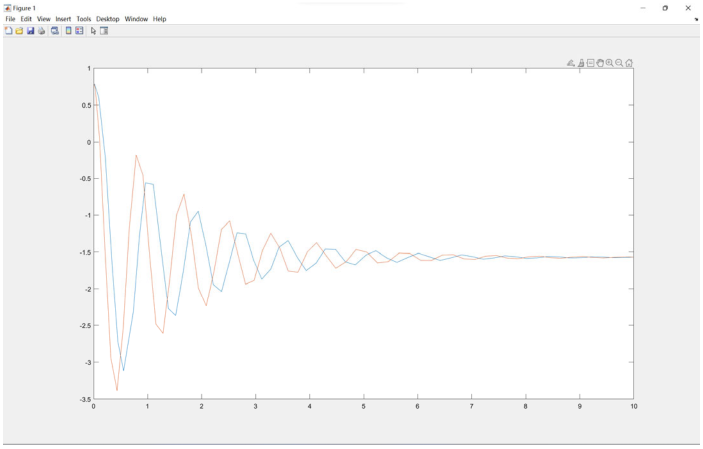




Q1.b

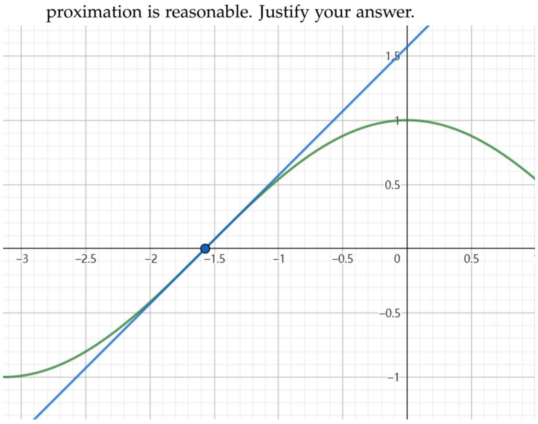


Q2.a



Q2.b

(b) Propose a range of initial conditions for which the linear approximation is reasonable. Justify your answer.



$$-\pi \leq \theta_0 \leq 0$$
$$0 \leq \theta_0 \leq \theta$$

from the graph we can see clearly two functions only close to each other at around -π/2

Q2.c

(c) A nonlinear model is typically more accurate than the linear model, but also more costly to implement. What engineering considerations might determine whether a linear approximation is appropriate?

Because solving linear equation is easier than non-linear system. But using linear equation instead we need to consider the tolerance. That is to say we need control the error between linear and non-linear equation within appropriate range, like 5% or less.

3. In the analysis of the quarter-car model:

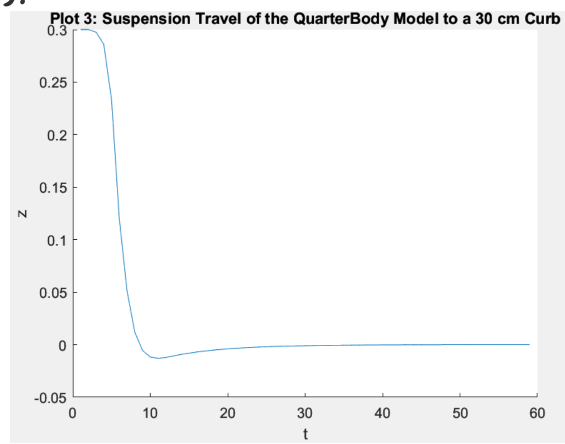
(a) Plot the suspension travel $z(t)$ when the input is a 0.3 m step. Give the plot the title "Plot 3: Suspension Travel of the Quarter-Body Model to a 30 cm Curb", and label the x and y axes.

$z = r - x$

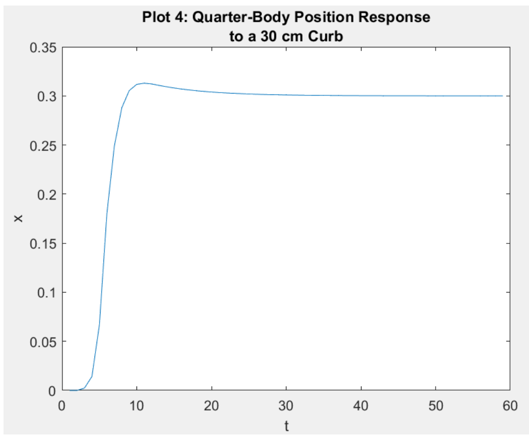
(b) Plot the body position $x(t)$ when the input is a 0.3 m step. Give the plot the title "Plot 4: Quarter-Body Position Response to a 30 cm Curb", and label the x and y axes.

(c) Suppose that you were designing the suspension so that the passengers of the vehicle would be protected from the effects of the car hitting the curb. What dynamic information would you want to obtain from the quarter-body simulation so that you could tell if a person could be hurt by the collision with the curb? For example, which signal in your block diagram would provide the dynamical information that is most closely related to an injury? Explain your answer.

a).



b)



c).

I need to obtain information of acceleration. Because F=ma. So I plot another graph of second derivative of x(t)