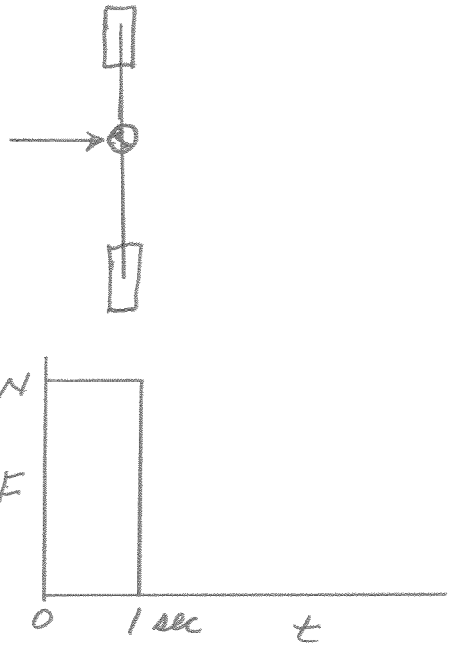
Homework #6
MEEM4450/5450
60 Points due 4/26/2013

1. Consider the situation where a vehicle is subjected to a lateral force applied at the cg with the front steering angle fixed at zero. The lateral force as a function of time is shown below. Calculate the position of the neutral steer point and the response of the vehicle to this input for the three sets of axle characteristics given below. You should show the neutral steer position for each case on a sketch which also shows the cg location. You should also plot the yaw, side slip and x, y location of the cg for each case for t between 0 and 4 secs.



Case 1 Cornering stiffness front axle: 148.0 kN/rad
Cornering stiffness rear axle: 86.0 kN/rad

Case 2 Cornering stiffness front axle: 156.0 kN/rad
Cornering stiffness rear axle: 107.25 kN/rad

Case 3 Cornering stiffness front axle: 110.0 kN/rad
Cornering stiffness rear axle: 120.0 kN/rad

Vehicle Speed= 60 km/hr
Vehicle mass= 1500 kg
Vehicle moment of inertia= 2400 kg m^2
a=1.1 m
b=1.6 m

2. Consider a vehicle that has the upper and lower ball joint of the right front suspension located as given below. Calculate the caster angle, kingpin inclination angle, caster trail and kingpin lateral offset at ground for the suspension. Show your answers on a sketch.

Co-ordinates of the upper and lower ball joint are given relative to an axis system whose origin is located 1000 mm behind the front axle at wheel spindle height and in the center plane of the vehicle. The vehicle has a track with of 1240 mm and a wheel base of 2550 mm. The wheel/tire radius is 300 mm.

Upper ball joint position (986.9, -500, 250) mm
Lower ball joint position (1010.5, -562.8, -200) mm

3. Calculate the pitch and bounce natural frequencies and the oscillation centers for the vehicle described below. Show the oscillation centers on a sketch.

   Weight=2300lbs
   Wheel base=100 in.
   Distance from cg to front axle= 45 in.
   kf=142 lb/in
   kr=152 lb/in
   rg=36 in