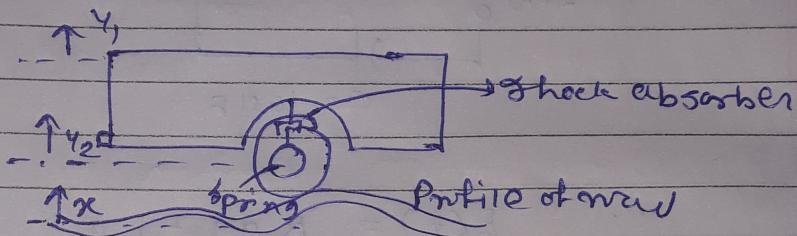
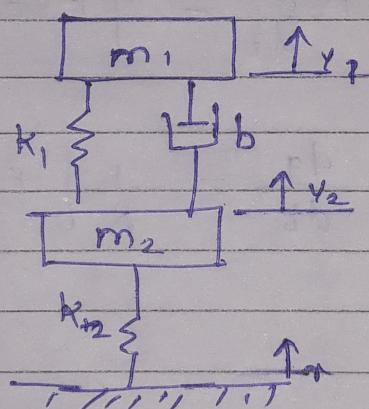


Q.3 The suspension system for one wheel of an old-fashioned pickup truck is illustrated in Fig. The mass of the vehicle is m_1 & the mass of the wheel is m_2 . The suspension spring has a spring constant k_1 & the tire had the spring constant k_2 . The damping Constant of the shock absorber is b . Obtain the mathematical model which represent the vehicle response to bump in the road & simulate it for 100 sec. Create a dummy input slg to represent



The FBD for the suspension system



m_1 = mass of vehicle

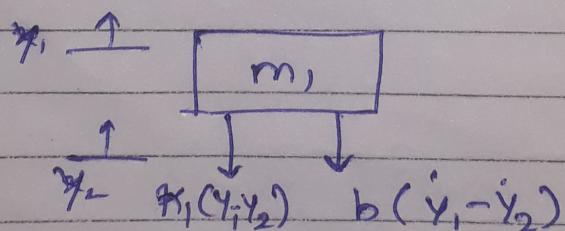
k_1 = suspension spring

b = damping constant

k_2 = tire spring const

m_2 = mass of tire.

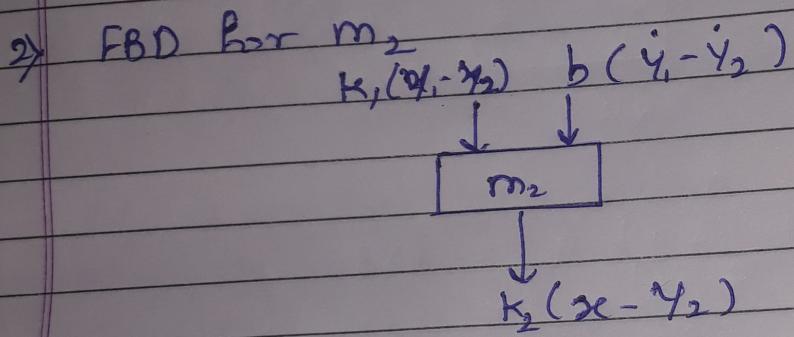
∴ FBD for m_1



$$\therefore m_1 \frac{d^2 y_1}{dt^2} = -k_1(y_1 - y_2) - b(\dot{y}_1 - \dot{y}_2)$$

$$\therefore m_1 \ddot{y}_1 = -k_1(y_1 - y_2) - b(\dot{y}_1 - \dot{y}_2)$$

$$\therefore \ddot{y}_1 = \frac{1}{m_1} [-k_1(y_1 - y_2) - b(\dot{y}_1 - \dot{y}_2)]$$



$$\therefore m_2 \ddot{y}_2 = k_1(y_1 - y_2) + b_1(\dot{y}_1 - \dot{y}_2) + k_2(x - y_2)$$

$$\therefore \ddot{y}_2 = \frac{1}{m_2} [k_1(y_1 - y_2) + b_1(\dot{y}_1 - \dot{y}_2) + k_2(x - y_2)]$$