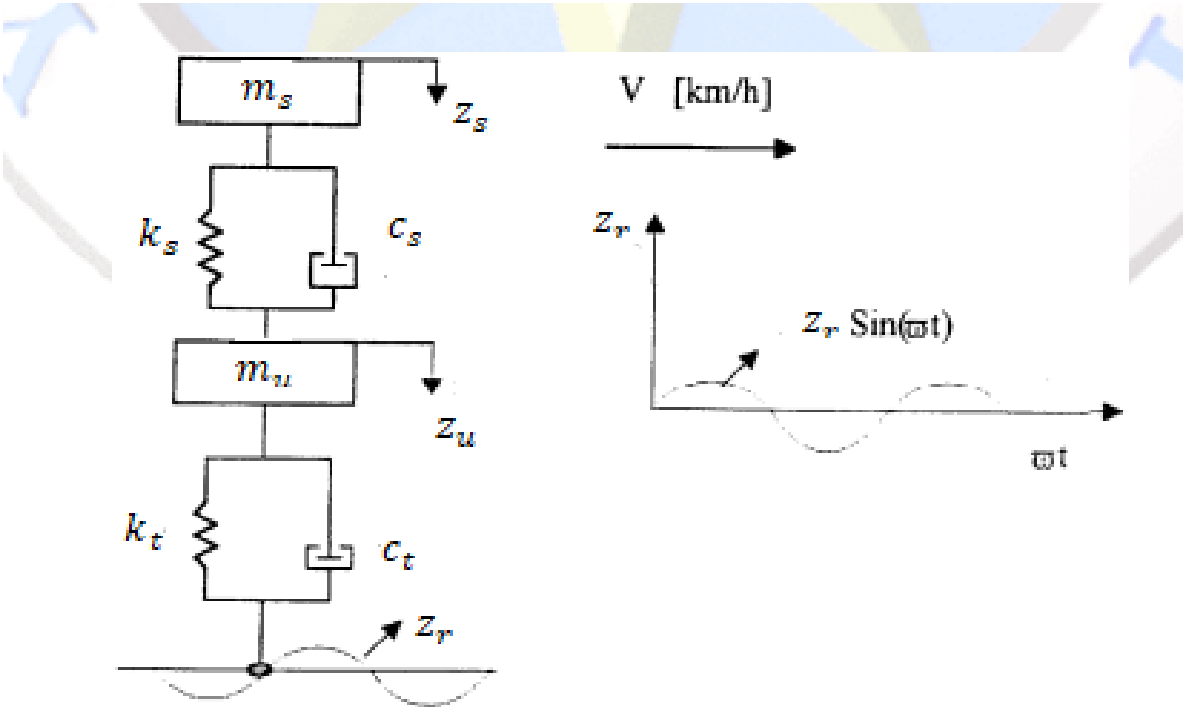


Şekil 2. Çeyrek taşıt modeli

Lagrange Denklemi

$$\frac{d}{dt}\left(\frac{\partial E_k}{\partial \dot{q}_i}\right) - \frac{\partial E_k}{\partial q_i} + \frac{\partial E_p}{\partial q_i} + \frac{\partial E_c}{\partial \dot{q}_i} = Q_i$$

q_i: Genelleştirilmiş Koordinat

E_k: Kinetik Enerji

E_p: Potansiyel Enerji

E_c: Sönüm Enerjisi Enerji

Q_i: Genelleştirilmiş Kuvvet

$$E_k = \frac{1}{2} m_s (\dot{z}_S)^2 + \frac{1}{2} m_u (\dot{z}_u)^2$$

$$E_p = \frac{1}{2} k_s (z_s - z_u)^2 + \frac{1}{2} k_t (z_u - z_r)^2$$

$$E_c = \frac{1}{2} c_s (\dot{z}_s - \dot{z}_u)^2 + \frac{1}{2} c_t (\dot{z}_u - \dot{z}_r)^2$$

z_s Genelleştirilmiş Koordinatı İçin

$$\frac{d}{dt}\left(\frac{\partial E_k}{\partial \dot{z}_s}\right) = \frac{d}{dt}\left(\frac{1}{2}(m_s \dot{z}_S)\right) = \frac{d}{dt}(m_s \dot{z}_S) = m_s \ddot{z}_s$$

$$\frac{\partial E_k}{\partial z_s} = 0$$

$$\frac{\partial E_p}{\partial z_s} = \frac{1}{2} 2k_s(z_s - z_u) = k_s(z_s - z_u)$$

$$\frac{\partial E_c}{\partial \dot{z}_s} = \frac{1}{2} 2c_s(\dot{z}_s - \dot{z}_u) = c_s(\dot{z}_s - \dot{z}_u)$$

$$Q_{z_s} = 0$$

$$\boldsymbol{m_s \ddot{z}_s + k_s(z_s - z_u) + c_s(\dot{z}_s - \dot{z}_u) = 0}$$

z_u Genelleştirilmiş Koordinatı İçin

$$\frac{d}{dt}\left(\frac{\partial E_k}{\partial \dot{z}_u}\right) = \frac{d}{dt}\left(\frac{1}{2}(m_u \dot{z}_u)\right) = \frac{d}{dt}(m_u \dot{z}_u) = m_u \ddot{z}_u$$

$$\frac{\partial E_k}{\partial z_u} = 0$$

$$\frac{\partial E_p}{\partial z_u} = -\frac{1}{2} 2k_s(z_s - z_u) + \frac{1}{2} 2k_t(z_u - z_r) = -k_s(z_s - z_u) + k_t(z_u - z_r)$$

$$\frac{\partial E_c}{\partial \dot{z}_u} = -\frac{1}{2} 2c_s(\dot{z}_s - \dot{z}_u) + \frac{1}{2} 2c_t(\dot{z}_u - \dot{z}_r) = -c_s(\dot{z}_u - \dot{z}_r) + c_t(\dot{z}_u - \dot{z}_r)$$

$$Q_{z_u} = 0$$

$$\boldsymbol{m_u \ddot{z}_u + -k_s(z_s - z_u) + k_t(z_u - z_r) - c_s(\dot{z}_s - \dot{z}_u) + c_t(\dot{z}_u - \dot{z}_r) = 0}$$

$$m_s\ddot{z}_s + k_s(z_s - z_u) + c_s(\dot{z}_s - \dot{z}_u) = 0$$
$$m_u\ddot{z}_u + -k_s(z_s - z_u) + k_t(z_u - z_r) - c_s(\dot{z}_s - \dot{z}_u) + c_t(\dot{z}_u - \dot{z}_r) = 0$$

$$\begin{bmatrix} m_s & 0 \\ 0 & m_u \end{bmatrix}\begin{bmatrix} \ddot{z}_s \\ \ddot{z}_u \end{bmatrix} + \begin{bmatrix} c_s & -c_s \\ -c_s & c_s + c_t \end{bmatrix}\begin{bmatrix} \dot{z}_s \\ \dot{z}_u \end{bmatrix} + \begin{bmatrix} k_s & -k_s \\ -k_s & k_s + k_t \end{bmatrix}\begin{bmatrix} z_s \\ z_u \end{bmatrix} = \begin{bmatrix} 0 \\ c_t \end{bmatrix}[\dot{z}_r] + \begin{bmatrix} 0 \\ k_t \end{bmatrix}[z_r]$$

$$m_s\ddot{z}_s + k_s(z_s - z_u) + c_s(\dot{z}_s - \dot{z}_u) = 0$$
$$m_u\ddot{z}_u = -k_s(z_s - z_u) + k_t(z_u - z_r) - c_s(\dot{z}_s - \dot{z}_u) + c_t(\dot{z}_u - \dot{z}_r) = 0$$

$$\ddot{z}_s = \left(\frac{-1}{m_s}\right)\left(k_s(z_s - z_u) + c_s(\dot{z}_s - \dot{z}_u)\right)$$

$$\ddot{z}_u = \left(\frac{-1}{m_u}\right)\left(-k_s(z_s - z_u) + k_t(z_u - z_r) - c_s(\dot{z}_s - \dot{z}_u) + c_t(\dot{z}_u - \dot{z}_r)\right)$$

$z_s \rightarrow \mathrm{u}(1)$

$\dot{z}_s \rightarrow \mathrm{u}(2)$

$z_u \rightarrow \mathrm{u}(3)$

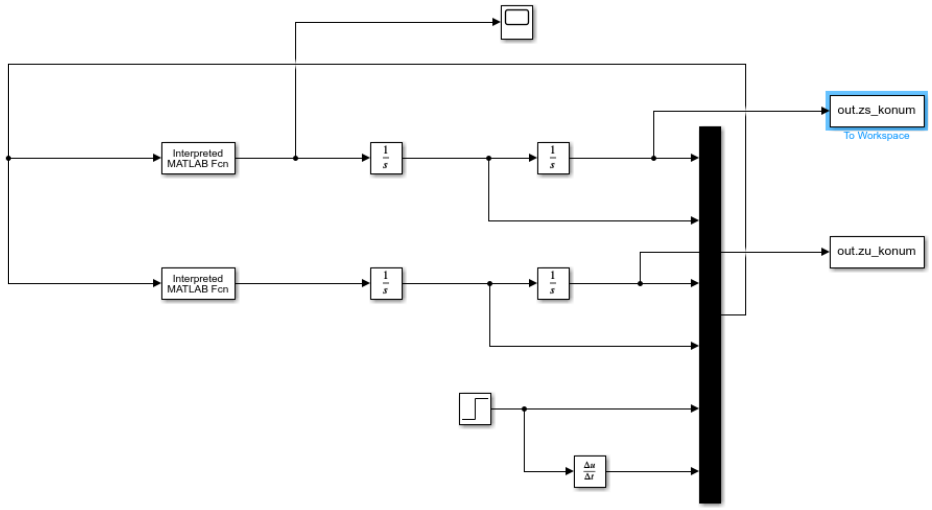
$\dot{z}_u \rightarrow \mathrm{u}(4)$

$z_r \rightarrow \mathrm{u}(5)$

$\dot{z}_r \rightarrow \mathrm{u}(6)$

(-1/ms)*(ks* (u(1)-u(3))+cs *(u(2)-u(4)))

(-1/mu)*(-ks*(u(1)-u(3))+kt* (u(3)-u(5))-cs *(u(2)-u(4))+ct* (u(4)-u(6)))




```
%Parametreler:
ms=290;      % kg    -->   % AnaGövde Kütlesi
mu=40;       % kg    -->   %Süspansiyon Kütlesi
ks=13000;    % N/m   -->   %Süspansiyon Yay Katsayısı
kt=220000;   % N/m   -->   %Tekerlek Yay katsayısı
cs=1000;     % Ns/m  -->   %Süspasiyon Sönümü Katsayısı
ct=0;        % Ns/m  -->   %Tekerlek Sönümü Katsayısı

sim('proje1')

plot(out.zs_konum)
```