Example 4-6: Car Driving Over a Curb.

Purpose:

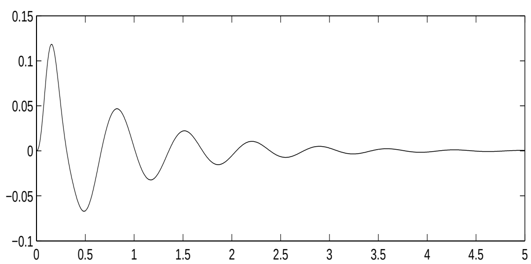
For the biomechanical model, compute and plot the head's vertical velocity as a function of time, in response to the car going over a curb 1 cm in height. Assume m_1=8.164 kg, m_2=11.953 kg, m_3=11.654 kg, m_4=5.018 kg (representing average values for an adult human being) and b_i=90 N·s/m and k_i=3500 N/m for i =1,2,3.

Inputs:

M1, M2, M3, M4=model masses in kg. B=model damping constant in N·s/m. K=model spring constant in N/m.

Output:

Y=vertical velocity of head in m/s.



Comments:

- This is the only program that does not work using the Mathscript program included on the DVD. It requires MATLAB and MATLAB's Symbolic Toolbox.
- Note that M1 does not affect the output; it is attached directly to the input.

Program:

```
clear;syms s;
M1=8.164;M2=11.953;
M3=11.654;M4=5.018;
B=90;K=3500;E=B+K/s;
%Use formulae from the text.
%Form 3X3 system matrix:
A=[M2*s+2*E,-E,0];
A=[A;-E,M3*s+2*E,-E];
A=[A;0,-E,M4*s+E];
B=[E;0;0];V=A\B;V4=V(3);
%Convert symbolic solution
%to non-symbolic solution:
[N,D]=numden(V4);
N=sym2poly(N);
D=sym2poly(D);
[R P]=residue(N,D);
t=linspace(0,5,1000);
Y=0.01*real(R.'*exp(P*t));
subplot(211),plot(t,Y)
```