

Stănică Roxana

Determinati functiile de sensibilitate $S_m^y(t)$, $S_{KR}^y(t)$ si $S_{KV}^y(t)$ si reprezentati grafic aceste functii pentru urmatorul sistem:

$$\begin{cases} \dot{x}(t) = v(t) \\ \dot{v}(t) = -\frac{KR}{m}x(t) - \frac{KV}{m}v(t) + a(t) \end{cases} \quad \text{unde } m=100\text{g, } KR=100\text{N/m, } KV=1\text{N/s}$$

Rezolvare:

$$\begin{pmatrix} \dot{x}(t) \\ \dot{v}(t) \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -\frac{KR}{m} & -\frac{KV}{m} \end{pmatrix} \begin{pmatrix} x(t) \\ v(t) \end{pmatrix} + \begin{pmatrix} 0 \\ 1 \end{pmatrix} a(t)$$

$$\Rightarrow A = \begin{pmatrix} 0 & 1 \\ -\frac{KR}{m} & -\frac{KV}{m} \end{pmatrix}, B = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

$$\begin{cases} \dot{S}_m^y(t) = AS_m^y(t) + \frac{\partial A}{\partial m} \begin{pmatrix} x(t) \\ v(t) \end{pmatrix} + \frac{\partial B}{\partial m} a(t) \\ \dot{S}_{KR}^y(t) = AS_{KR}^y(t) + \frac{\partial A}{\partial KR} \begin{pmatrix} x(t) \\ v(t) \end{pmatrix} + \frac{\partial B}{\partial KR} a(t) \\ \dot{S}_{KV}^y(t) = AS_{KV}^y(t) + \frac{\partial A}{\partial KV} \begin{pmatrix} x(t) \\ v(t) \end{pmatrix} + \frac{\partial B}{\partial KV} a(t) \end{cases}$$

$$\begin{pmatrix} \dot{x}(t) \\ \dot{v}(t) \end{pmatrix} = A \begin{pmatrix} x(t) \\ v(t) \end{pmatrix} + Ba(t)$$

$$\text{fie } \dot{y}(t) = \begin{pmatrix} \dot{x}(t) \\ \dot{v}(t) \end{pmatrix} \text{ si } y(t) = \begin{pmatrix} x(t) \\ v(t) \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} \dot{S}_m^y(t) \\ \dot{S}_{KR}^y(t) \\ \dot{S}_{KV}^y(t) \\ \dot{y}(t) \end{pmatrix} = \begin{pmatrix} A & O_{2 \times 2} & O_{2 \times 2} & AM \\ O_{2 \times 2} & O_{2 \times 2} & O_{2 \times 2} & AKR \\ O_{2 \times 2} & O_{2 \times 2} & A & AKV \\ O_{2 \times 2} & O_{2 \times 2} & O_{2 \times 2} & A \end{pmatrix} \cdot \begin{pmatrix} S_m^y(t) \\ S_{KR}^y(t) \\ S_{KV}^y(t) \\ y(t) \end{pmatrix} + \begin{pmatrix} B1 \\ B1 \\ B1 \\ B \end{pmatrix} a(t)$$

$$\text{unde } O_{2 \times 2} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

$$A = \begin{pmatrix} 0 & 0 \\ -10^3 & -10 \end{pmatrix}$$

$$B = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

$$AM = \frac{\partial A}{\partial m} = \begin{pmatrix} 0 & 0 \\ \frac{KR}{m^2} & \frac{KV}{m^2} \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 10^5 & 10^2 \end{pmatrix}$$

$$AKR = \frac{\partial A}{\partial KR} = \begin{pmatrix} 0 & 0 \\ -\frac{1}{m} & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ -10 & 0 \end{pmatrix}$$

$$AKV = \frac{\partial A}{\partial KV} = \begin{pmatrix} 0 & 0 \\ 0 & -\frac{1}{m} \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & -10 \end{pmatrix}$$

$$B1 = \frac{\partial B}{\partial m} = \frac{\partial B}{\partial KR} = \frac{\partial B}{\partial KV} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

pentru a scrie programul vom folosi notatiile : $X = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$, $Y = \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

$$\Rightarrow A_{tot} = \begin{pmatrix} A & X & X & AM \\ X & A & X & AKR \\ X & X & A & AKV \\ X & X & X & A \end{pmatrix}, B_{tot} = \begin{pmatrix} B1 \\ B1 \\ B1 \\ B \end{pmatrix}$$

$$C_{tot} = \begin{pmatrix} Y & X & X & X \\ X & Y & X & X \\ X & X & Y & X \\ X & X & X & Y \end{pmatrix}, D_{tot} = \begin{pmatrix} B1 \\ B1 \\ B1 \\ B1 \end{pmatrix}$$

%program pentru reprezentarea grafica a functiilor de sensibilitate ale lui y(t) in raport cu parametrii m, KR si KV.

```
t=0:.0001:0.1;
a=cos(100*t);      %intrare armonica.
%a=sin(100*t);    %intrare sinusoidala.
%a=1+0*t;         %intrare treapta.
```

%matricile sistemului inainte de aplicarea functiilor de sensibilitate

```
A=[0 0;-10^3 -10];      %matricea A a sistemului
B=[0;1];               %matricea B a sistemului
C=[1 0;0 1];          %matricea C a sistemului
D=[0;0];               %matricea D a sistemului
```

%determinarea matricilor noului sistem dupa aplicarea functiilor de sensibilitate.

```
AM=[0 0;10^5 10^3];    %derivata lui A in raport cu parametrul m
AKR=[0 0;-10 0];      %derivata lui A in raport cu parametrul KR
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AKV=[0 0;0 -10];           %derivata lui A in raport cu parametrul KV
B1=[0;0];                  %derivatele lui B in raport cu parametrii m, KR, KV
X=[0 0;0 0];              % notatii folosite pentru calcularea matricilor
Y=[1 1;1 1];              %notatii folosite pentru calcularea matricilor

Atot=[A X X AM; X A X AKR; X X A AKV; X X X A]; %matricea A a noului sistem
Btot=[B1; B1;B1;B1];      %matricea B a noului sistem
Ctot=[Y X X X; X Y X X; X X Y X; X X X Y];    %matricea C a noului sistem
Dtot=[B1;B1;B1;B1];      %matricea D a noului sistem

%reprezentarea grafica a functiilor de sensibilitate si a iesirii noului sistem.
y=lsim(Atot,Btot,Ctot,Dtot,a,t);

subplot(211);
plot(t,y(:,1),'k');grid;
xlabel('Timp[secunde]');
ylabel('Amplitudine');
title('Functia de sensibilitate in raport cu m');

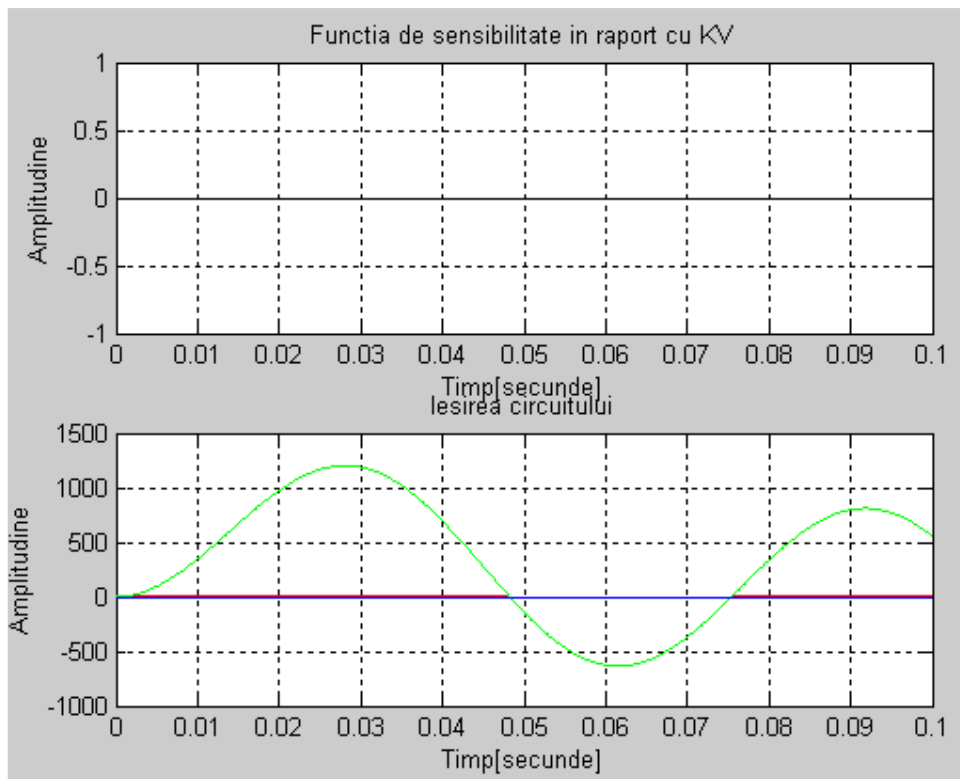
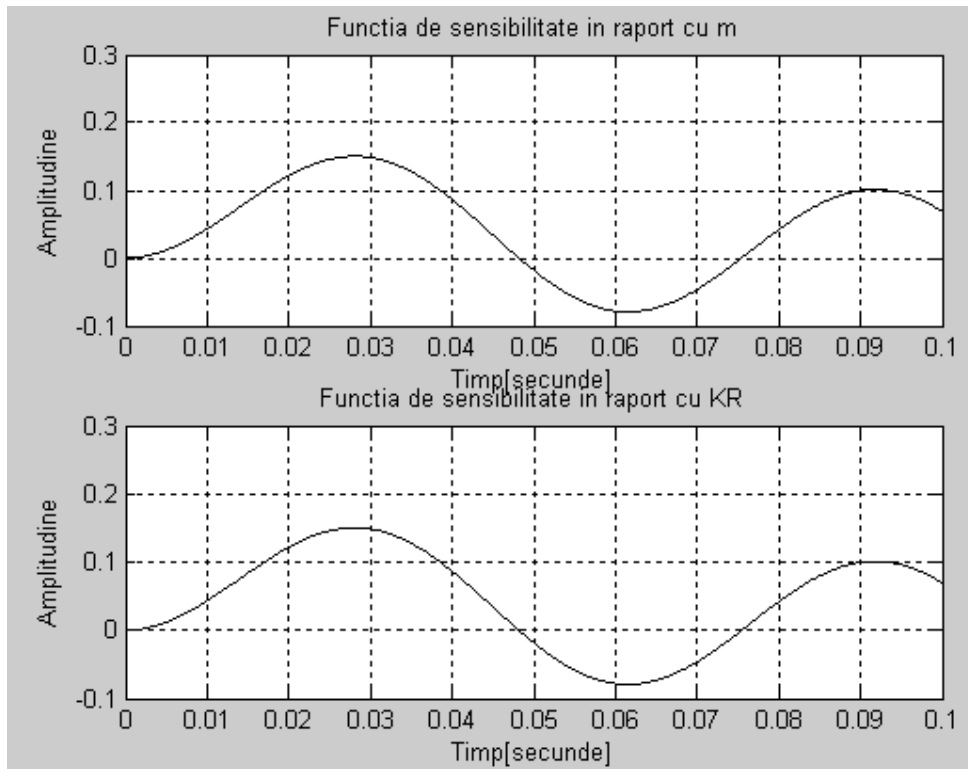
subplot(212);
plot(t,y(:,2),'k');grid;
xlabel('Timp[secunde]');
ylabel('Amplitudine');
title('Functia de sensibilitate in raport cu KR');

pause;
clf;
subplot(211);
plot(t,y(:,3),'k');grid;
xlabel('Timp[secunde]');
ylabel('Amplitudine');
title('Functia de sensibilitate in raport cu KV');

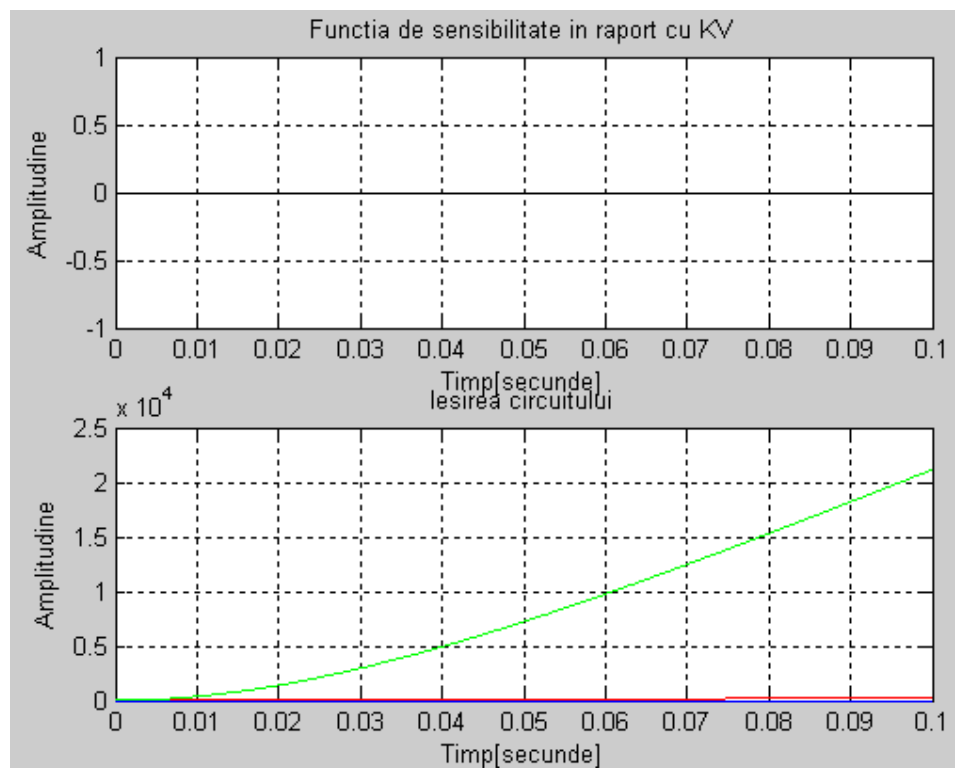
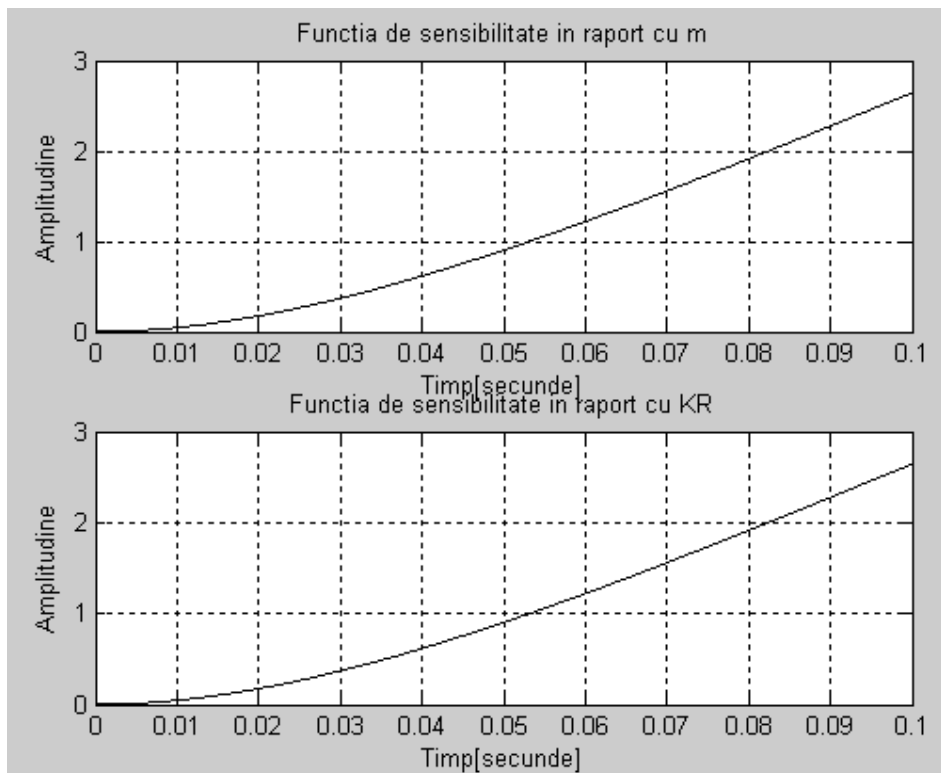
subplot(212);
plot(t,y(:,4),'k',t,y(:,4)+y(:,1).*100,'r',t,y(:,4)+y(:,2).*8.0e+3,'g',t,y(:,4)+y(:,3).*8.0e-7,'b');grid;
xlabel('Timp[secunde]');
ylabel('Amplitudine');
title('Iesirea circuitului');

```

Dupa rularea programului la intrare armonica se afiseaza:



Dupa rularea programului la intrare treapta se afiseaza:



Dupa rularea programului la intrare sinusoidala se afiseaza:

