Programy MATLAB z wykładu 7 Oct. 20

```
% Elastic Pendelum
clearvars
l0p=1.5;
vl0=0.0;
fi0=176/180*pi;
fi10=0;
grub=1;
tRange=[0:0.001:40];
Y0=[l0p;vl0;fi0;fi10];
[tSol,YSol]=ode113(@elapen,tRange,Y0);
figure
plot(tSol,((YSol(:,1)-l0p))*100,'b','LineWidth',grub);
hold on
plot(tSol,YSol(:,2),'r','LineWidth',grub);
xlabel('time [s]'); ylabel('elongation [cm] speed [m/s]');
legend('delta length ','speed');
hold off
figure
plot((YSol(:,1)-l0p)*100,YSol(:,2),'LineWidth',grub)
xlabel('alongation [cm]');
ylabel('speed [m/s]');
title('Trajectoty of the pivot: displacement-speed');
figure
plot(tSol,180/pi*YSol(:,3),'m','LineWidth',grub);
hold on
plot(tSol,180/pi*YSol(:,4),'c','LineWidth',grub);
legend('angle','speed')
xlabel('time [s]'); ylabel('angle [deg]');
hold off
figure
plot(180/pi*YSol(:,3),180/pi*YSol(:,4),'LineWidth',grub)
xlabel('angle [deg]');
ylabel('speed [deg/s]');
title('Trajectoty of the pendelum: angle-speed');
function dYdt=elapen(t,Y)
l0=1.5;
g=9.81;
m=5.0;
F=5.0;
k=5000;
Dfi=0.2;
Dl=1.0;
 l=Y(1);
 l1=Y(2);
 fi=Y(3);
 fi1=Y(4);
 dldt=l1;
 dl1dt=l*fi1^2-k/m*(l-l0)+g*cos(fi)+F/m*sin(fi)-Dl/m*l1;
 dfidt=fi1;
 dfi1dt=-2*l1/l*fi1-g/l*sin(fi)+F/l*cos(fi)-Dfi/l*fi1;
 dYdt=[dldt;dl1dt;dfidt;dfi1dt];
end
```

```
% mobile pendelum on horizontal spring
% x2 - angular speed; y2 - linear speed of pivot
% x1 - pedelum swing; y1 - position of the pivot
clearvars;
tspan=[0 60.0];
global d0; d0=0.3;
Y0=[175/180*pi d0+0.0 0 0];
global m1; m1=20.0; global m2; m2=60.0;
global l; l=2.5; global Q; Q=0.0;
global k1; k1=5000;
global D2; D2=4.0; global D1; D1=100.0;
global g; g=9.81;
grub=1.5;
[t,Y]=ode45(@mpend,tspan,Y0);
f1=figure;
plot(t,180/pi*Y(:,1),'LineWidth',grub)
xlabel('time [s]')
ylabel('[deg] [deg/s]')
title('Pendelum swing & speed')
hold on
plot(t,180/pi*Y(:,3),'LineWidth',grub)
legend('pendelum swing','pendelum speed')
hold off
f12=figure;
plot(180/pi*Y(:,1),180/pi*Y(:,3),'LineWidth',grub)
xlabel('[deg]')
ylabel('[deg/s]')
title('Pendelum swing & speed')
f2=figure;
plot(t,10*(Y(:,2)-d0),'LineWidth',grub)
xlabel('time [s]')
ylabel('[dcm] [m/s]')
text(40.0,-0.06,'kl=20 000')
title('Pivot position & speed')
hold on
plot(t,Y(:,4),'LineWidth',grub)
legend('pos.','speed')
hold off
f21=figure;
plot((Y(:,2)-d0)*10,Y(:,4),'LineWidth',grub)
xlabel('[dcm]')
ylabel('[m/s]')
title('Pendelum swing & speed')
text(-0.07,0.05,'kl=20 000');
f3=figure; tf=500;
plot(t(1:tf),10*(Y(1:tf,2)-d0),'LineWidth',grub)
xlabel('time [s]')
ylabel('[dcm] [m/s]')
title('Pivot position & speed')
text(14.0,-0.06,'kl=20 000');
hold on
plot(t(1:tf),Y(1:tf,4),'LineWidth',grub)
legend('pos.','speed')
hold off
f4=figure;
plot(10*(Y(1:tf,2)-d0),Y(1:tf,4),'LineWidth',grub)
xlabel('[dcm]')
ylabel('[m/s]')
title(' Trajectory: Pivot position & speed')
text(-0.07,0.05,'kl=20 000');
numel(Y(:,1))
```

```
function dYdt=mpend(t,Y)
 global m1; global m2; global l; global Q;
 global k1; global d0; global D1; global D2; global g;
 x2=Y(3); y2=Y(4); x1=Y(1); y1=Y(2);
 Ap=[l cos(x1); l*m2*cos(x1) m1+m2];
 Aod=inv(Ap);
 ps4=l*m2*sin(x1)*x2^2+Q-D1*y2+k1*(d0-y1);
 ps3=Q*cos(x1)/m2-g*sin(x1)-(D2*x2)/(l*m2);
 dx1dt=x2;
 dy1dt=y2;
 dx2dt=Aod(1,1)*ps3+Aod(1,2)*ps4;
 dy2dt=Aod(2,1)*ps3+Aod(2,2)*ps4;
 dYdt=[dx1dt;dy1dt;dx2dt;dy2dt];
end
```

```
% name:Graetz_2; Type:Graetz Bridge 2Ty+2Dio
% T1 T2 Dio3 Dio4
clearvars
tRange=[0:0.0004:0.1];
i0=[0.0 0.0];
global Um; Um=500;
 f=50.0;
global omega; omega=2*pi*f;
global phi; phi=0;
 Ls=0.01; Ld=0.5;
global E; E=0.0;
global Rs; Rs=1.0; global Rd; Rd=50.0;
global iprog; iprog=0.02;
global Rblock; Rblock=1000;
global alpha1; alpha1=20/180*pi;
global alpha2; alpha2=20/180*pi;
 A=[Ld+Ls Ld-Ls; Ld-Ls Ld+Ls];
global A1; A1=inv(A);
 [tSol,YSol]=ode45(@Graetz,tRange,i0);
 [ID]=[YSol(:,1)+YSol(:,2)];
 figure
 plot(tSol,YSol(:,1),'LineWidth',1.5)
 xlabel('time [s]')
 ylabel('i1,i2 [A]')
 title('iT1 iT2 currents')
 opis={'alpha1=30 [deg]', 'alpha2=60 [deg]'};
 text(0.01,5.2,opis);
 hold on
 plot(tSol,YSol(:,2),'LineWidth',1.5)
 legend('iT1','iT2')
 hold off;
 figure
  plot(tSol,ID,'LineWidth',1.5)
   xlabel('time [s]')
 ylabel('id,is [A]')
```

```
 title('load & source currents')
  hold on
  plot(tSol,YSol(:,1)-YSol(:,2),'LineWidth',1.5)
   legend('id','is')
  hold off
function dYdt=Graetz(t,Y)
global Um; global omega; global phi;
global E; global Rs; global Rd; global iprog;
global Rblock; global A1; global alpha1;
global alpha2;
function Rez=rezystancja(x)
if x>0.1*iprog Rez=0.0002*Rblock;
elseif x>0.07*iprog Rez=0.05*Rblock;
elseif x>0.05*iprog Rez=0.1*Rblock;
elseif x>0.03*iprog Rez=0.2*Rblock;
elseif x>0.01*iprog Rez=0.5*Rblock;
elseif x>0 Rez=Rblock;
elseif x>-0.01*iprog Rez=2*Rblock;
elseif x>-0.03*iprog Rez=3*Rblock;
elseif x>-0.05*iprog Rez=4*Rblock;
elseif x>-0.07*iprog Rez=5*Rblock;
elseif x>-0.09*iprog Rez=6*Rblock;
elseif x>-0.11*iprog Rez=8*Rblock;
else Rez=10*Rblock;
end
end
 i1=Y(1); i2=Y(2);
 beta=omega*t+phi;
 beta1=mod(beta,2*pi); beta2=mod(beta-pi,2*pi);
 us=Um*sin(beta);
 RT1=10*Rblock; RT2=10*Rblock;
  RD3=rezystancja(i2); RD4=rezystancja(i1);
if beta1>alpha1
 RT1=rezystancja(i1);
end
if beta2>alpha2
 RT2=rezystancja(i2);
end
 ps1=us-E-(RT1+RD4+Rd+Rs)*i1+(-Rd+Rs)*i2;
 ps2=-us-E+(-Rd+Rs)*i1-(RT2+RD3+Rd+Rs)*i2;
 di1dt=A1(1)*ps1+A1(3)*ps2;
 di2dt=A1(2)*ps1+A1(4)*ps2;
 dYdt=[di1dt;di2dt];
end
```

```
% electric circuit 3M, 2Ty
% x2 - QA,QB,iA,iB,iC
% x1 - Ty2,Ty4
clearvars; format shortg;
c1=clock
tspan=[0:0.001:0.8];
Y0=[0.0 0.0 0.0 0.0 0.0];
global Um; Um=100.0; global E; E=-50.0;
global R1; R1=2.0; global R2; R2=5.0;
```

```
global R3; R3=3.0; global R4; R4=2.0;
global R5; R5=5.0; global L1; L1=0.005;
global L3; L3=0.02; global L4; L4=0.02;
global L5; L5=0.05;
global C2; C2=0.01; f=15.0;
global omega; omega=2*pi*f;
global phi; phi=90/180*pi;
global alpha1; alpha1=0/180*pi;
global alpha2; alpha2=0/180*pi;
grub=1.5;
M=[L1 0 0;0 L3+L4 -L4;0 -L4 L4+L5];
global Mod; Mod=inv(M);
[t,Y]=ode45(@circuit1,tspan,Y0);
f1=figure;
plot(t,Y(:,3),'LineWidth',grub)
xlabel('time [s]')
ylabel('i1,i2,i3 [A]')
title('i1,i2,i3 currents; f=15 [Hz], E=-50 [V]')
hold on
plot(t,Y(:,3)-Y(:,4),'LineWidth',grub)
plot(t,Y(:,4),'LineWidth',grub)
legend('i1','i2','i3');
hold off
f12=figure;
plot(t,(Y(:,1)-Y(:,2))/C2,'LineWidth',grub)
xlabel('time [s]')
ylabel(' UC [V]')
title('Capacitor voltage; f=15 [Hz], E=-50 [V ')
f2=figure;
plot(t,Y(:,4)-Y(:,5),'LineWidth',grub)
xlabel('time [s]')
ylabel('i4,i5 [A]')
title('i4,i5 currents; f=15 [Hz], E=-50 [V')
hold on
plot(t,Y(:,5),'LineWidth',grub)
legend('i4','i5')
hold off
numel(Y(:,1))
c2=clock
czas=c2-c1
function dYdt=circuit1(t,Y)
 global Um; global E; global R1; global R2;
 global R3; global R4; global R5;
 global C2; global alpha1; global alpha2;
 global Mod; global omega; global phi;
 QA=Y(1); QB=Y(2); iA=Y(3); iB=Y(4); iC=Y(5);
 iprog=0.03; Rblock=1000;
 ang=omega*t+phi;
 ang1=mod(ang,2*pi);
 RT2=Rblock; RT4=Rblock;
 if ang1>alpha1 RT2=rezystancja(iA-iB); end
 if ang1>alpha2 RT4=rezystancja(iC-iB); end
 u=Um*sin(ang);
 ps3=(-R1-R2-RT2)*iA+(R2+RT2)*iB+u+(1/2)*(-2*QA+2*QB)/C2;
 ps4=(R2+RT2)*iA+(-R2-R3-R4-RT4-RT2)*iB+(R4+RT4)*iC+(1/2)*(2*QA-2*QB)/C2;
 ps5=(R4+RT4)*iB+(-R4-R5-RT4)*iC-E;
dQAdt=iA;
dQBdt=iB;
diAdt=Mod(1)*ps3+Mod(4)*ps4+Mod(7)*ps5;
diBdt=Mod(2)*ps3+Mod(5)*ps4+Mod(8)*ps5;
diCdt=Mod(3)*ps3+Mod(6)*ps4+Mod(9)*ps5;
```

```
 dYdt=[dQAdt;dQBdt;diAdt;diBdt;diCdt];
function Rez=rezystancja(x)
if x>0.1*iprog Rez=0.0002*Rblock;
elseif x>0.07*iprog Rez=0.05*Rblock;
elseif x>0.05*iprog Rez=0.1*Rblock;
elseif x>0.03*iprog Rez=0.2*Rblock;
elseif x>0.01*iprog Rez=0.5*Rblock;
elseif x>0 Rez=Rblock;
elseif x>-0.01*iprog Rez=2*Rblock;
elseif x>-0.03*iprog Rez=3*Rblock;
elseif x>-0.05*iprog Rez=4*Rblock;
elseif x>-0.07*iprog Rez=5*Rblock;
elseif x>-0.09*iprog Rez=6*Rblock;
elseif x>-0.11*iprog Rez=8*Rblock;
else Rez=10*Rblock;
end
end
end
```