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DEPARTMENT: Biomedical Engineering

COURSE CODE: BME312

COURSE TITLE: Biological Systems Control and Modelling

Example 1.- Transfer function

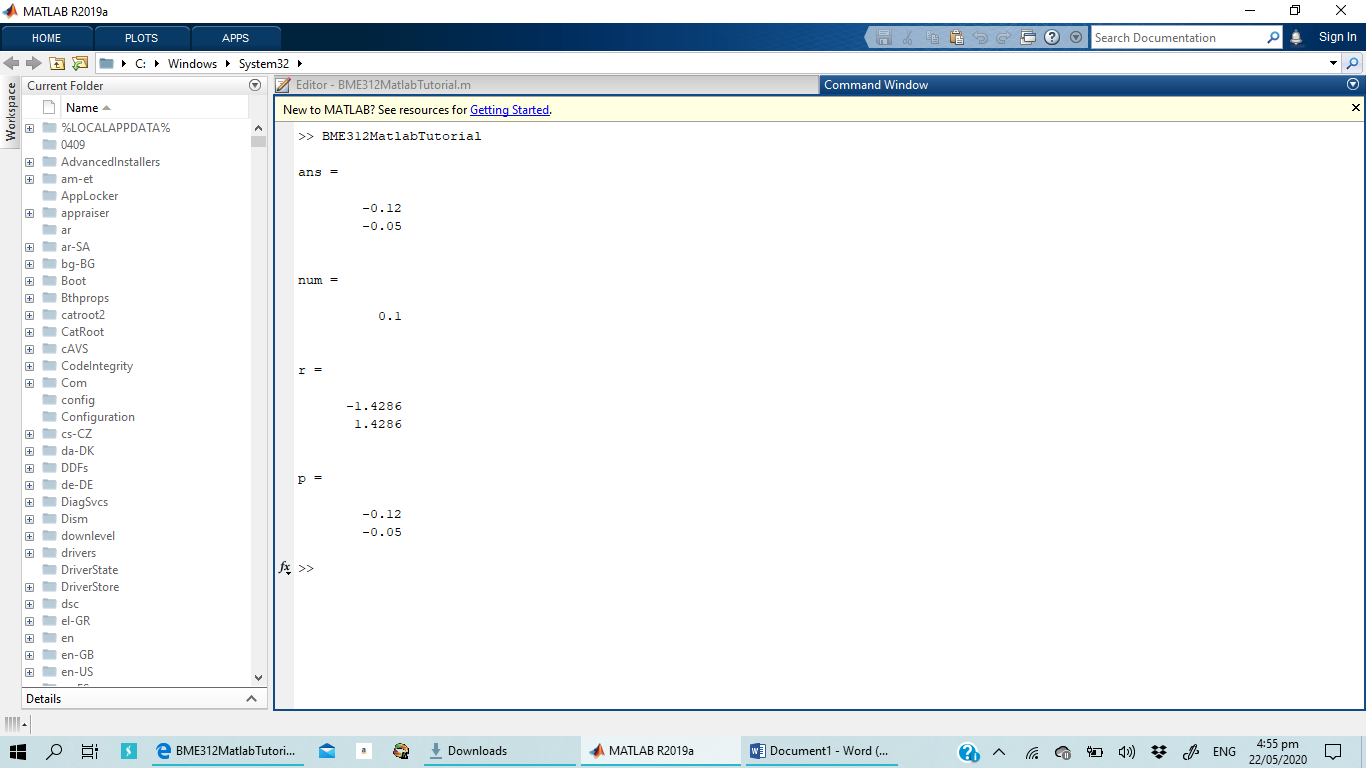
Q= (0.1)/((s^2)+(0.17\*s)+0.006) ;

den= [1 0.17 0.006];

roots(den)

num=[0.1]

[r,p]=residue(num,den)



Example 2.-Transfer Function

Q= (0.1)/((s^2)+(0.17\*s)+0.006) ;

den= [1 0.17 0.006];

roots(den)

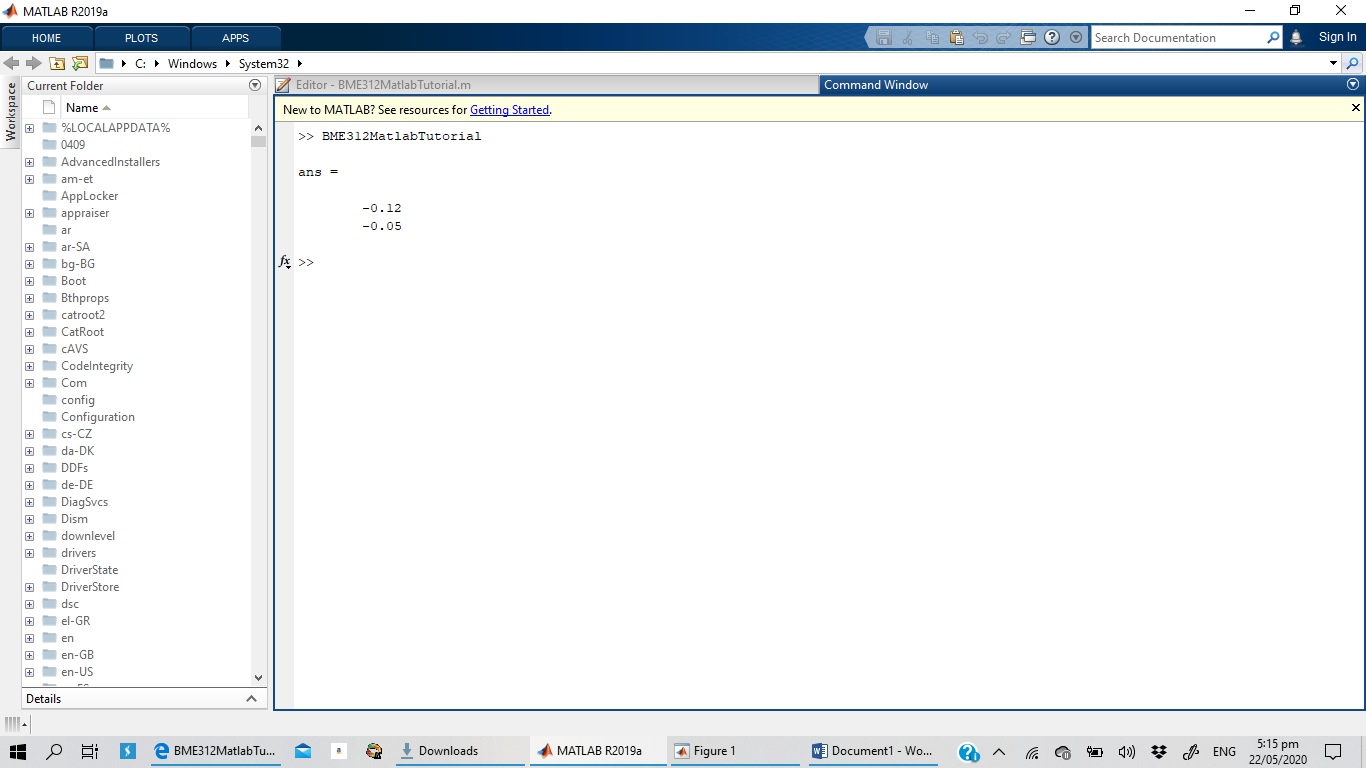
num=[0.1];

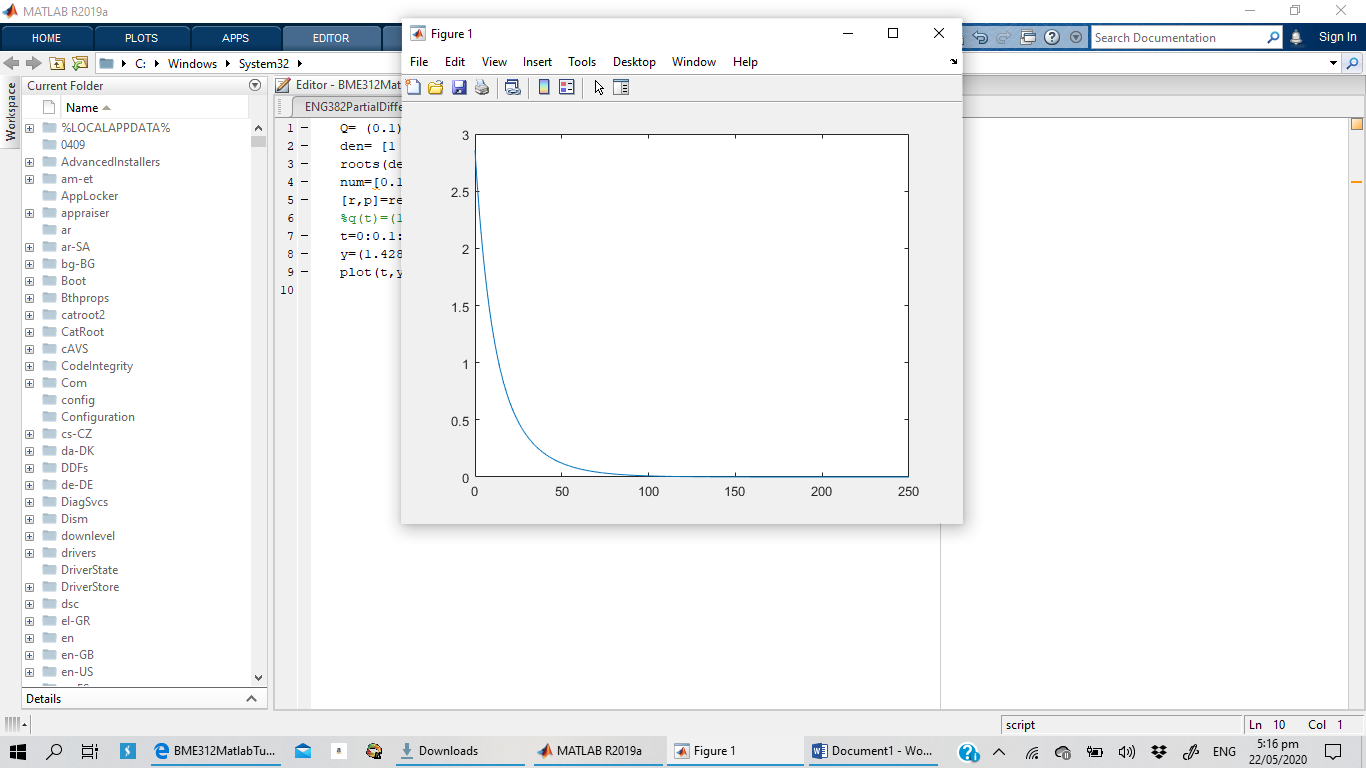
[r,p]=residue(num,den);

t=0:0.1:250;

y=(1.4286\*exp(-0.12\*t))+(1.4286\*exp(-0.05\*t));

plot(t,y)





Example 3- Step Response (Transfer Function)

Q= 6/((2\*s^3)+(2\*s^2)+s);

den= [2 3 1 0 ];

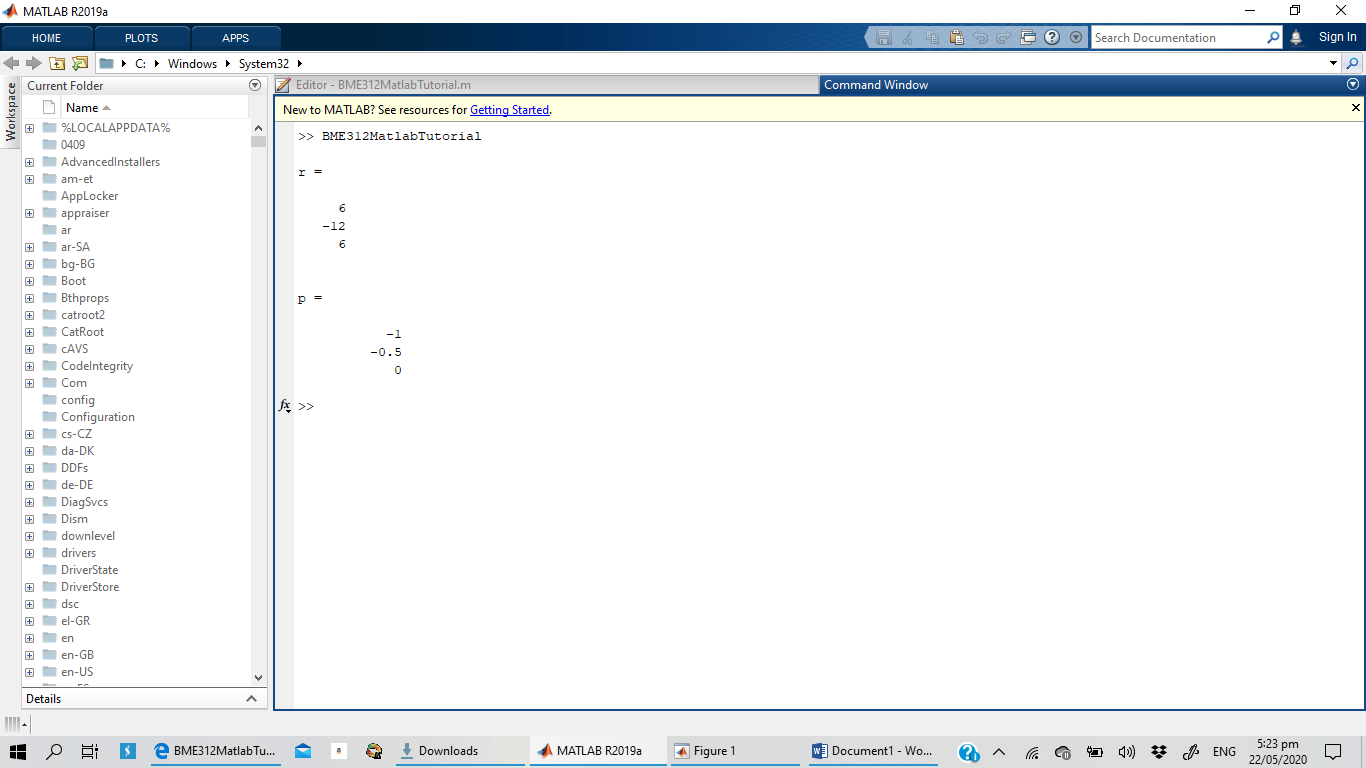
num=[6];

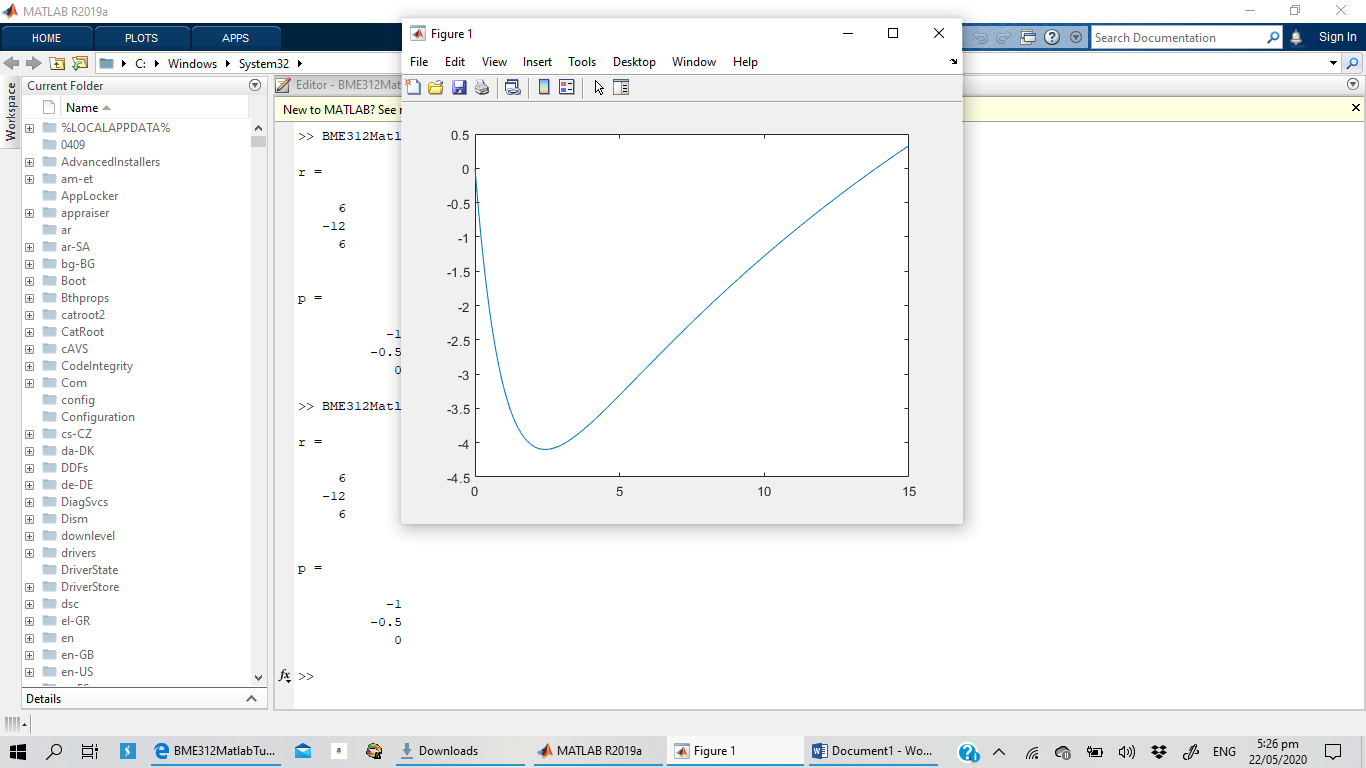
[r,p]=residue(num,den)

t=0:0.1:15;

y=6+(6\*exp(-t))-(12\*exp(-0.05\*t));

plot(t,y)





Using second Code

Q= 6/((2\*s^3)+(3\*s^2)+s);

den= [2 3 1 0 ];

num=[6];

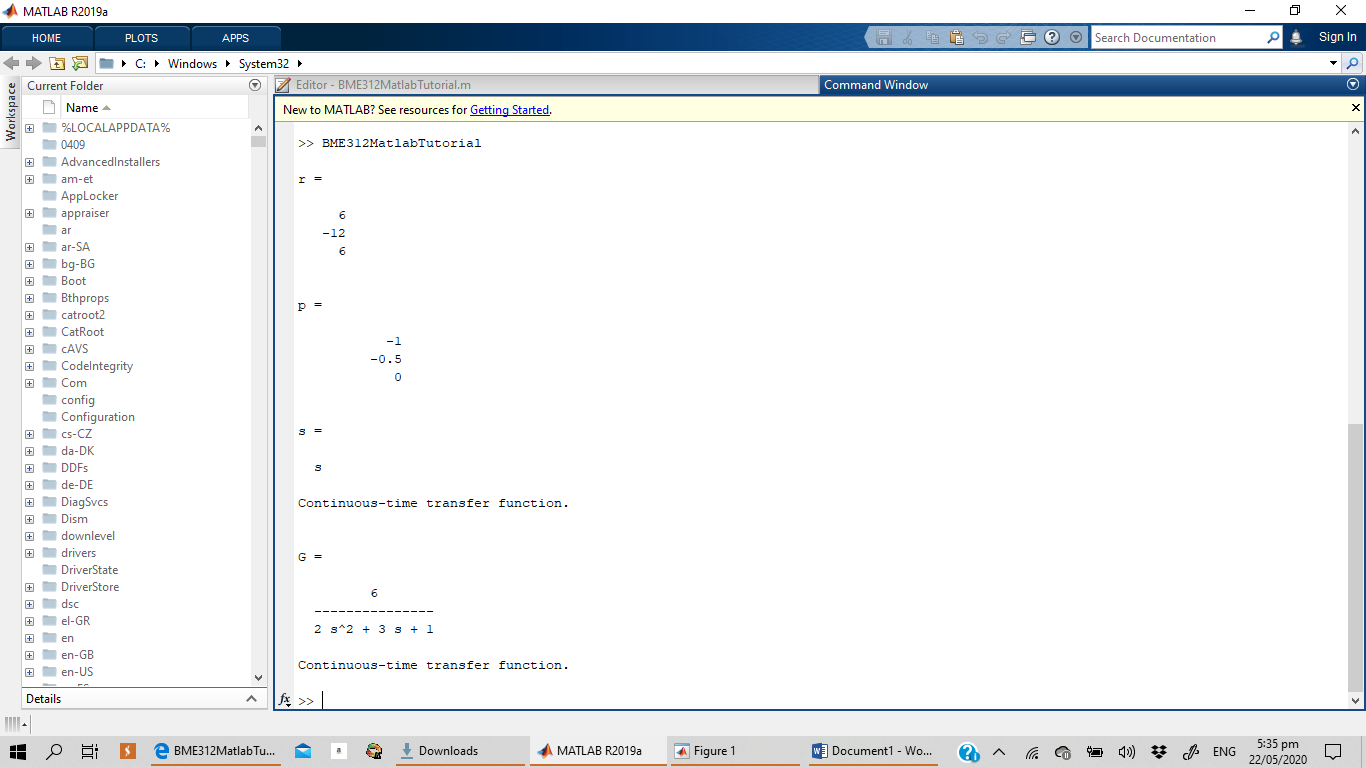
[r,p]=residue(num,den)

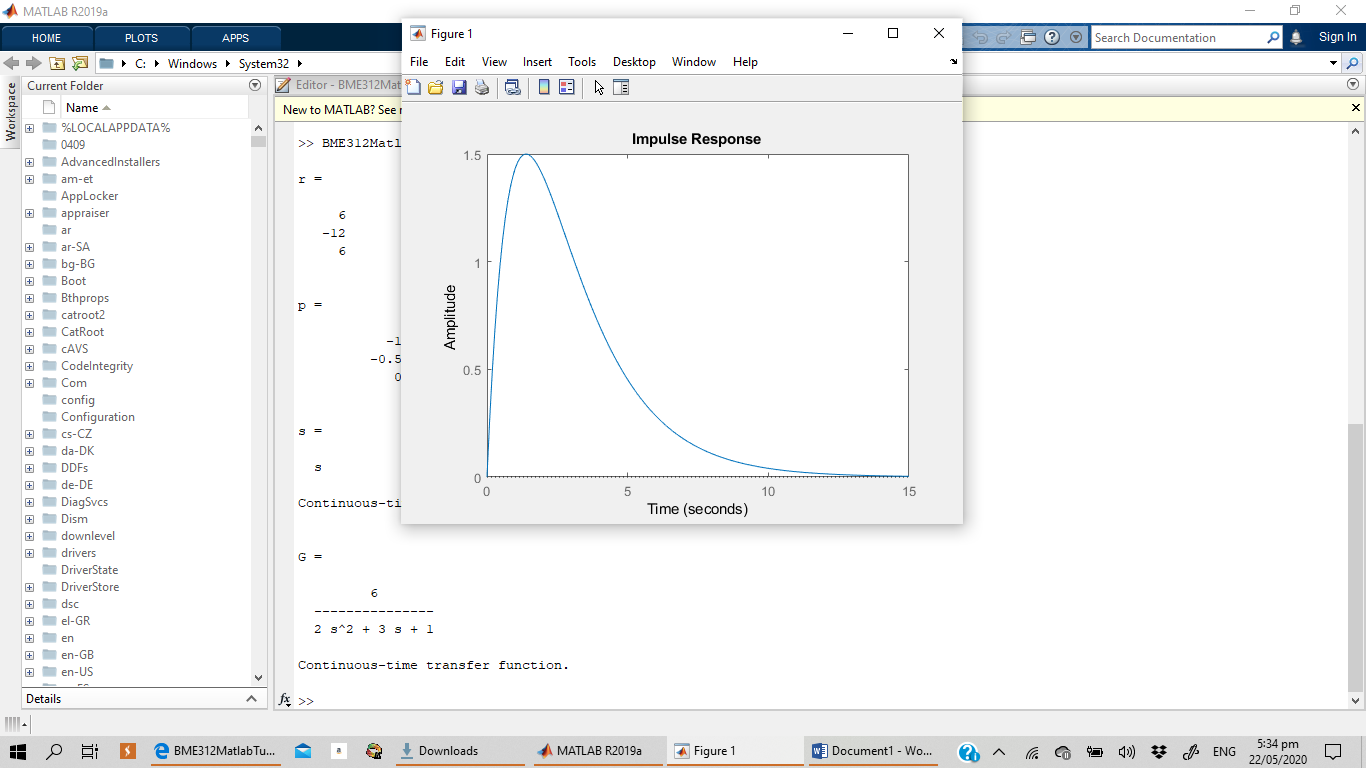
s=tf('s')

G=6/((2\*s^2)+(3\*s)+1)

step(G,15)

impulse(G,15)





Example 4- Compartmental Model

syms s VT VA VL UFR KTA KTL KA KL

VA = KTA/((s+KA)\*VT);

VL= KTL/((s+KL)\*VT);

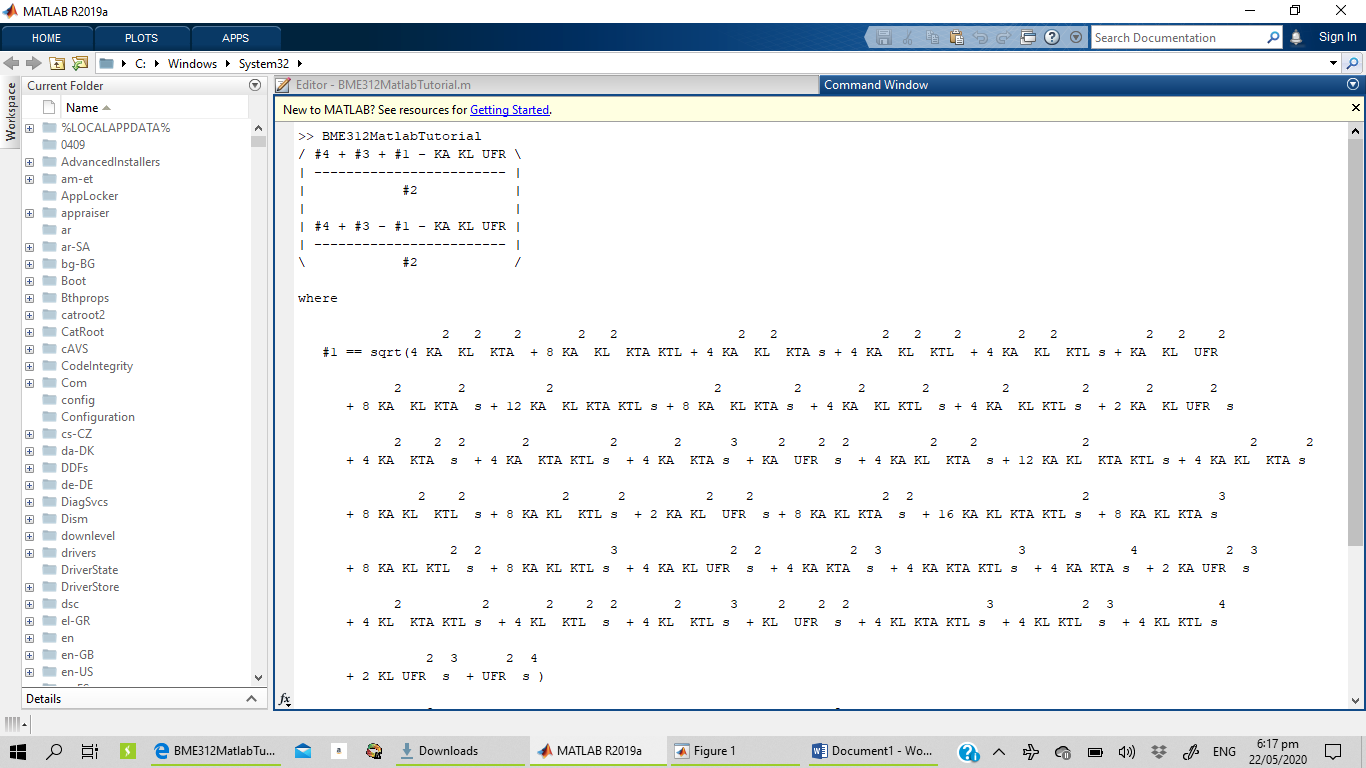
eq=VT==((KA/(s+KTA+KTL))\*VA)+ ((KL/(s+KTA+KTL))\*VL)-((1/(s+KTA+KTL))\*UFR);

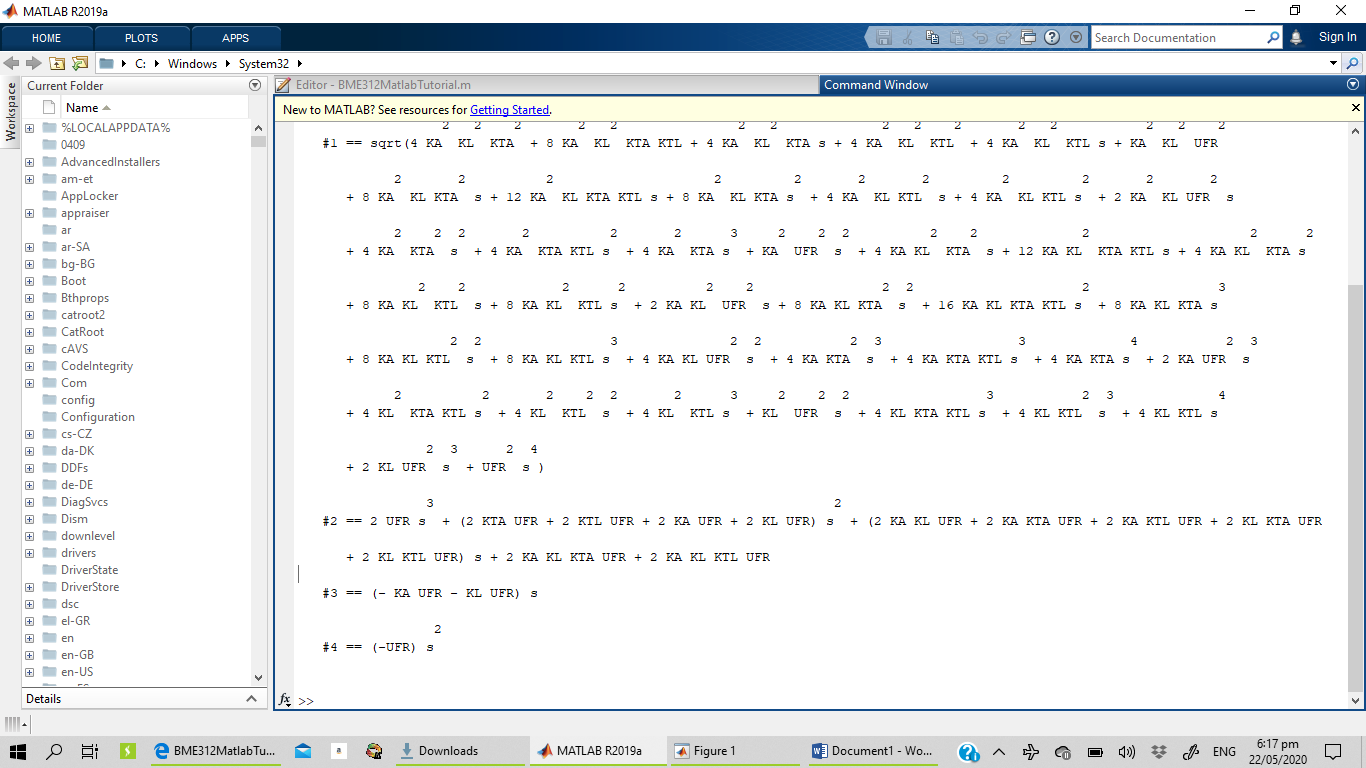
VT= solve(eq,VT);

G= VT/UFR;

G=collect(G);

pretty(G);





Example 5

syms s VT VA VL UFR KTA KTL KA KL

VA = KTA/((s+KA)\*VT);

VL= KTL/((s+KL)\*VT);

eq=VT==((KA/(s+KTA+KTL))\*VA)+ ((KL/(s+KTA+KTL))\*VL)-((1/(s+KTA+KTL))\*UFR);

VT= solve(eq,VT);

G= VT/UFR;

G=collect(G);

pretty(G);

G=subs(G, [KA, KL, KTA, KTL], [0.15, 0.25, 0.33, 0.25]);

[numGs, denGs]=numden(G);

numG=sym2poly(numGs);

denG=sym2poly(denGs);

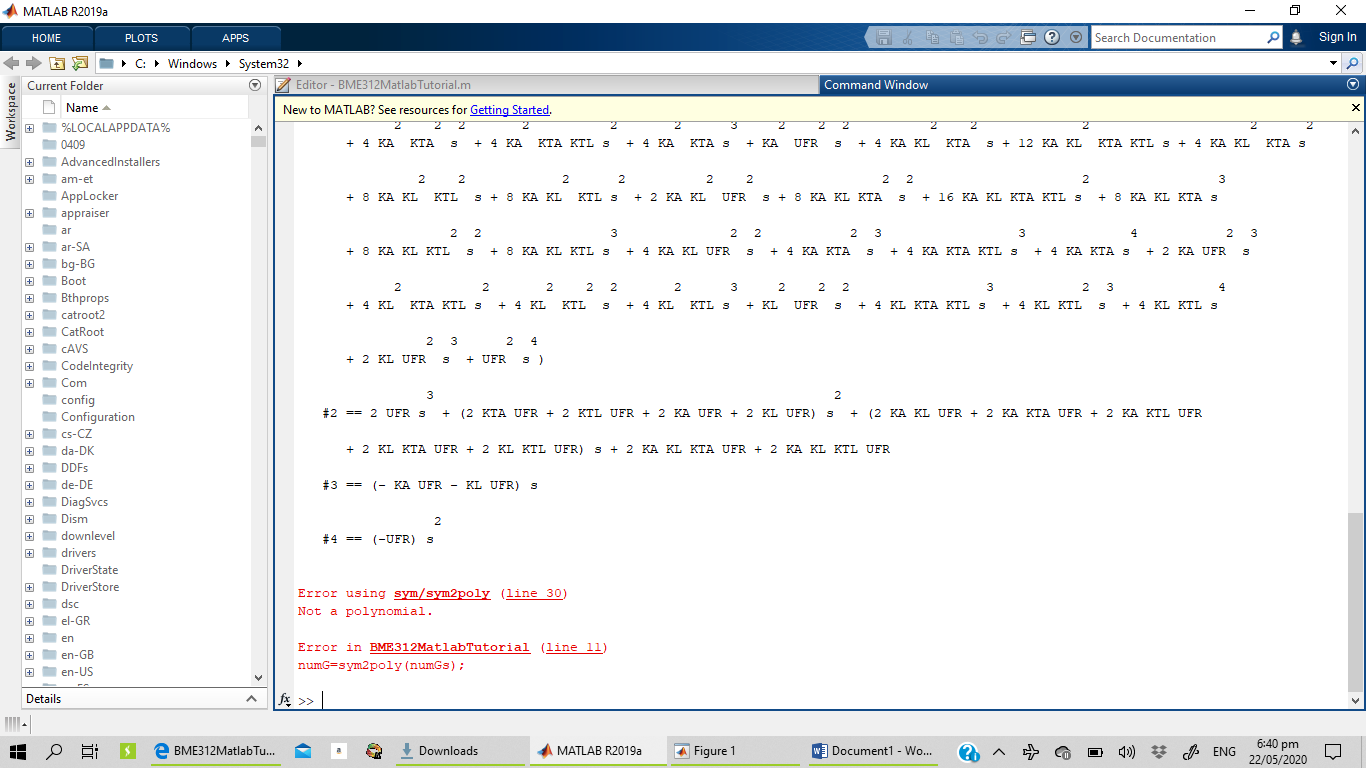
G= tf(numG,denG);

G=minreal(numG,denG);

ZerosG=zero(G);

polesG=pole(G);

p2map(G);



*%CODE DID NOT RUN!!!!*

Example 5.

K=2;

m= (K\*G)/((K\*G)-1);

%M=minreal(m);

display(m)

[ir,t]=impulse(m);

sr=step(m,t);

figure

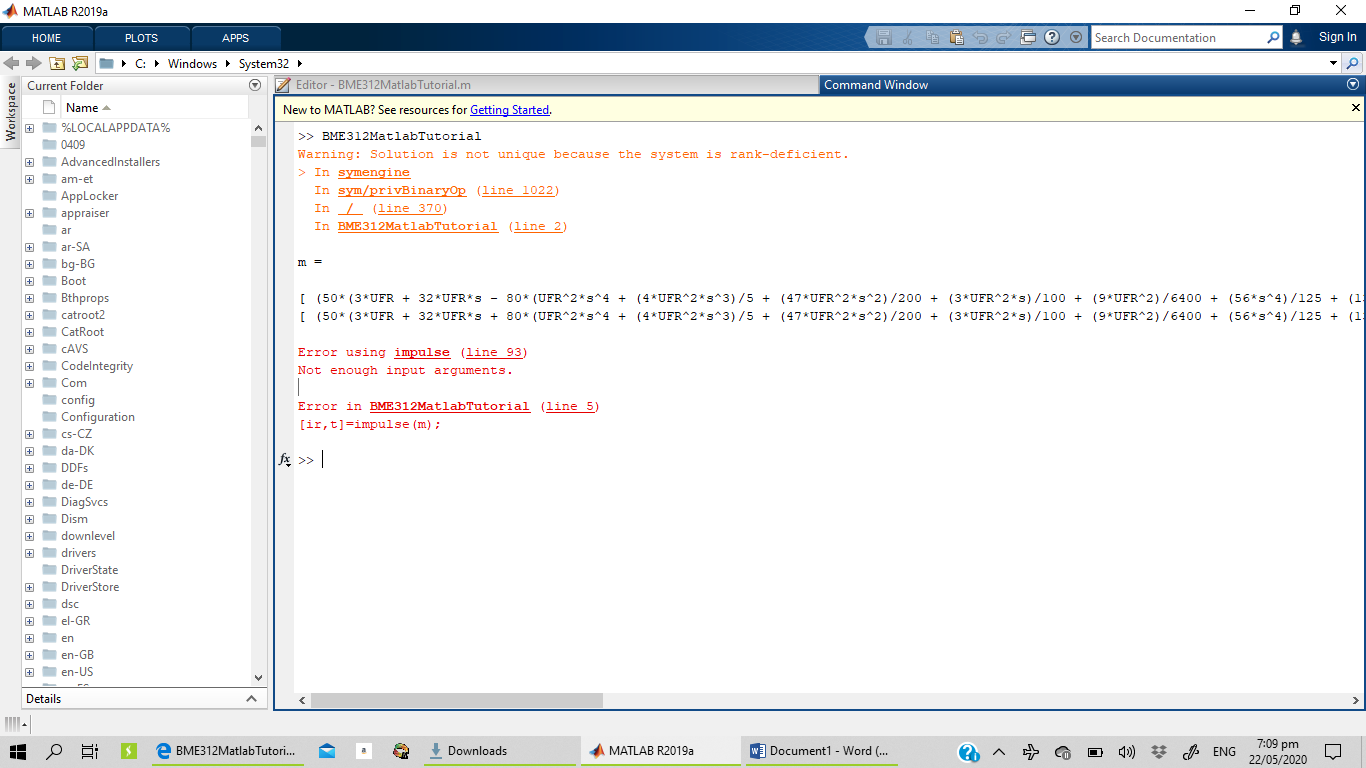
plot(t,ir,'b',t,sr,'r')

axis tight

legend({'impulse response','step response'},'location','Best')

xlabel('time')

ylabel('V\_T(t)')



Example 6- Drug Administration

syms t tp

dc\_dt=diff(c,t);

tp=solve(dc\_dt==0,t);

pretty(tp);

cp=subs(c,t,tp);

pretty(cp);

D0=500;

Vd=10;

par.D0=D0;

par.Vd=Vd;

par.tp=8;

par.cp=30;

x=fsolve(x, absEstimRateEquations(x,par), [2,1]);

ka=x(1);

ke=x(2);

display(ka);

functionF= absElimRateEquation(x, par);

ka= x(1);

ke=x(2);

Vd=par.vd;

tp=log(ka/ke)/(ka-ke);

A= (D0\*ka)/(Vd\*(ka-ke));

cp=(A\*exp(-ke\*tp))-(A\*exp(-ka\*tp));

eq1=tp-par.tp;

eq2=cp-par.cp;

F=[eq1 eq2];



%DID NOT RUN