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6 APPENDIX

Appendix I

```
% tuned T/F for operationality and transparency

s = tf('s');
Mnm=0.3;
Mns=0.1;
a=2;
b=2;
g_dis=700;
g_reac=700;
Kp=8600;
Kf=1.16;

Gte=g_reac/(g_reac+s);
Gsd=g_dis/(g_dis+s);
Kvm=41.47    %2*(Mns*Kp/b)^(0.5)
Kvs=101.59   %2*(Mnm*Kp)^(0.5)
Cpm=Kp+Kvm*s;
Cps=Kp+Kvs*s;
Cf=Kf;

U=s^2+(a*Cps+b*Cpm)/(Mnm*Mns);
V=Mnm*(s^2+b*Cpm/(Mnm*Mns));
W=Mnm*(s^2+a*Cps/(Mnm*Mns));
I=Gte*Cf*((Mnm/Mns)*a+b)+Gsd*Mnm;
D=Gte*Cf*U+Gsd*Cps/Mnm;

H11=(Mnm^2*s^2*U)/D;
H12=Mnm*(Gte*Cf*b*U+Gsd*V)/(Mns*D);
H21=(Gte*Cf*a*(Mnm/Mns)*U+Gsd*W)/D;
H22=Gsd*I/(Mns*D);

Ke=3600;
De=8;
Ze=Ke+s*De;

opts = bodeoptions;
opts.FreqUnits = 'rad/s';
opts.Grid='on';
opts.Xlim=[0.1,10000];

T1=H21/(H11+H12*Ze);     %master system transfer fn

Figure (1)
bodeplot (T1,opts);
Po=H11/(H21+H22*Ze);
Pr=H12/(H21+H22*Ze);
Figure (2)
bodeplot (Pr,opts)
Figure (3)
bodeplot (Po,opts)
```

Appendix II

```
% tuned T/F for rlocus% varying alpha.
s = tf('s');

Mnm=0.3;
Mns=0.1;
a=1;
b=1;
g_dis=700;
g_reac=700;
Kp=8600;
Kf=1.16;
Ke=3500;
De=10;
Ze=Ke+s*De;

Gte=g_reac/(g_reac+s);
Gsd=g_dis/(g_dis+s);
Kvm=2*(Mns*Kp/b)^(0.5);
Kvs=2*(Mnm*Kp)^(0.5);
Cpm=Kp+Kvm*s;
Cps=Kp+Kvs*s;
Cf=Kf;
points=40;

av=linspace(1,4000,points);

for i=1:points
 a=av(i);
U=s^2+(a*Cps+b*Cpm)/(Mnm*Mns);
V=Mnm*(s^2+b*Cpm/(Mnm*Mns));
W=Mnm*(s^2+a*Cps/(Mnm*Mns));
I=Gte*Cf*((Mnm/Mns)*a+b)+Gsd*Mnm;
D=Gte*Cf*U+Gsd*Cps/Mnm;

H11=(Mnm^2*s^2*U)/D;
H12=Mnm*(Gte*Cf*b*U+Gsd*V)/(Mns*D);
H21=(Gte*Cf*a*(Mnm/Mns)*U+Gsd*W)/D;
H22=Gsd*I/(Mns*D);

T1=H21/(H11+H12*Ze);

plot(pole(T1),'x');hold;
end;
```

Appendix III

```
% tuned T/F for rlocus% varying beta.
s = tf('s');

Mnm=0.3;
Mns=0.1;
a=1;
b=1;
g_dis=700;
g_reac=700;
Kp=8600;
Kf=1.16;
Ke=3500;
De=10;
Ze=Ke+s*De;

Gte=g_reac/(g_reac+s);
Gsd=g_dis/(g_dis+s);
Kvm=2*(Mns*Kp/b)^(0.5);
Kvs=2*(Mnm*Kp)^(0.5);
Cpm=Kp+Kvm*s;
Cps=Kp+Kvs*s;
Cf=Kf;
points=40;

av=linspace(1,2000,points);

for i=1:points
    b=av(i);
U=s^2+(a*Cps+b*Cpm)/(Mnm*Mns);
V=Mnm*(s^2+b*Cpm/(Mnm*Mns));
W=Mnm*(s^2+a*Cps/(Mnm*Mns));
I=Gte*Cf*((Mnm/Mns)*a+b)+Gsd*Mnm;
D=Gte*Cf*U+Gsd*Cps/Mnm;

H11=(Mnm^2*s^2*U)/D;
H12=Mnm*(Gte*Cf*b*U+Gsd*V)/(Mns*D);
H21=(Gte*Cf*a*(Mnm/Mns)*U+Gsd*W)/D;
H22=Gsd*I/(Mns*D);

T1=H21/(H11+H12*Ze);

plot(pole(T1),'x');hold;
end;
```

Appendix IV

```
% tuned T/F for rlocus% varying Kp
s = tf('s');

Mnm=0.3;
Mns=0.1;
a=2;
b=2;
g_dis=700;
g_reac=700;
Kp=1;
Kf=1.16;
Ke=3500;
De=10;
Ze=Ke+s*De;

points=40;
av=linspace(1,8600,points);

for i=1:points
    Kp=av(i);
Gte=g_reac/(g_reac+s);
Gsd=g_dis/(g_dis+s);
Kvm=2*(Mns*Kp/b)^(0.5);
Kvs=2*(Mnm*Kp)^(0.5);
Cpm=Kp+Kvm*s;
Cps=Kp+Kvs*s;
Cf=Kf;

U=s^2+(a*Cps+b*Cpm)/(Mnm*Mns);
V=Mnm*(s^2+b*Cpm/(Mnm*Mns));
W=Mnm*(s^2+a*Cps/(Mnm*Mns));
I=Gte*Cf*((Mnm/Mns)*a+b)+Gsd*Mnm;
D=Gte*Cf*U+Gsd*Cps/Mnm;

H11=(Mnm^2*s^2*U)/D;
H12=Mnm*(Gte*Cf*b*U+Gsd*V)/(Mns*D);
H21=(Gte*Cf*a*(Mnm/Mns)*U+Gsd*W)/D;
H22=Gsd*I/(Mns*D);

T1=H21/(H11+H12*Ze);

plot(pole(T1),'x');hold;
end;
```