APPENDIX B

Program for Determining Equivalent Damping Ratio
(400-m High Building with MTMD)

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%Program 2  Determining equivalent damping ratio
%(400-m high building with MTMD)

%2.1 Input building and MTMD properties
clear;
Mk=2;
Ms=1000;
Fs=0.09;
Fk=Fs;
Es=0.01;
Ek=0.02;
Wk=2*22*Fk/7;
Ws=2*22*Fs/7;
p=0.5*Ws;
Uk=Mk/(Ms);
Yk=Wk/Ws;

%2.2 Determine optimal equivalent damping ratio by classical procedure

%2.2.1 Determine building-complex-frequency-displcaement
% from equation of motion
i=0;
for p=-25*Ws:0.01*Ws:25*Ws,
RE=1-((p/Ws)^2)-(Uk*((p/Ws)^2)*(((Yk^2)*((Yk^2)-((p/Ws)^2)))
+((2*Ek*Yk*p/Ws)^2))/((((Yk^2)-((p/Ws)^2))^2)+((2*Ek*Yk*p/Ws)^2)));
IM=(2*Es*p/Ws)+(2*Uk*Ek*Yk*((p/Ws)^5))/((((Yk^2)-((p/Ws)^2))^2)
+((2*Ek*Yk*p/Ws)^2));
Yk=Yk-0.07;
RE1=(Uk*((p/Ws)^2)*(((Yk^2)*((Yk^2)-((p/Ws)^2)))+((2*Ek*Yk*p/Ws)^2))
/((((Yk^2)-((p/Ws)^2))^2)+((2*Ek*Yk*p/Ws)^2)));
IM1=(2*Uk*Ek*Yk*((p/Ws)^5))/((((Yk^2)-((p/Ws)^2))^2)+((2*Ek*Yk*p/Ws)^2));
Yk=Yk+0.035;
RE2=(Uk*((p/Ws)^2)*(((Yk^2)*((Yk^2)-((p/Ws)^2)))+((2*Ek*Yk*p/Ws)^2))
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/((((Yk^2)-((p/Ws)^2))^2)+((2*Ek*Yk*p/Ws)^2)));
IM2=(2*Uk*Ek*Yk*((p/Ws)^5))/((((Yk^2)-((p/Ws)^2))^2)+((2*Ek*Yk*p/Ws)^2));
Yk=Yk+0.07;
RE3=(Uk*((p/Ws)^2)*(((Yk^2)*((Yk^2)-((p/Ws)^2)))+((2*Ek*Yk*p/Ws)^2))
/((((Yk^2)-((p/Ws)^2))^2)+((2*Ek*Yk*p/Ws)^2)));
IM3=(2*Uk*Ek*Yk*((p/Ws)^5))/((((Yk^2)-((p/Ws)^2))^2)+((2*Ek*Yk*p/Ws)^2));
Yk=Yk+0.035;
RE4=(Uk*((p/Ws)^2)*(((Yk^2)*((Yk^2)-((p/Ws)^2)))+((2*Ek*Yk*p/Ws)^2))
/((((Yk^2)-((p/Ws)^2))^2)+((2*Ek*Yk*p/Ws)^2)));
IM4=(2*Uk*Ek*Yk*((p/Ws)^5))/((((Yk^2)-((p/Ws)^2))^2)+((2*Ek*Yk*p/Ws)^2));

Yk=Wk/Ws;

sumRE=RE-RE1-RE2-RE3-RE4;
sumIM=IM+IM1+IM2+IM3+IM4;
sumDMF=1/(sumRE^2+sumIM^2);
i=i+1;
s(i)=sumDMF;
end
l=(-25:0.01:25);

%2.2.2 Plot building-complex-frequency-displcaement with frequency p/Ws

plot(l,s)
xlabel('W/w ratio')
ylabel('Displacement (m)')

%2.2.3 Determine optimal equivalent damping rato base-on area under the
%graph
EE=3.1416/(2*(trapz(l,s)))
```