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format compact;

% Beam in Transverse Vibration
% Natural Freq. v. Branch Diameter

b1l = 1.87510407; %From Table 6.6 (pg.539, Vibration Textbook)
lavg = 80; % Avg. Length of Branch (in.)
lmin = 22; % Min Length of Branch (in.)
lmax = 124; % Max Length of Branch (in.)
E = 2086e3; % Young's Modulus (lb/in^2)
rho = 0.0298; % Density (lbm/in^3)
davg = 2.84; % Avg. Branch Diameter (in.)
dmin = 1.27; % Min Branch Diameter (in.)
dmax = 5.33; % Max Branch Diameter (in.)

I = ((pi.*(davg.^4))./(64)); % Moment of Inertia (in^4)
A = ((pi.*(davg.^2))./(4)); % Cross-Sectional Area (in^2)

wlrad = ((b1l./lavg).^2).*sqrt((E.*I)./(rho.*(1./(32.2.*12)).*A));
wlHz = wlrad.*(1./(2.*pi));

figure (1)
wnl = @(dia) (((b1l./lavg).^2).*sqrt((E.*((pi.*(dia.^4))./(64)))./(rho.*(1./(32.2.*12)).*(pi.*(dia.^2))./(4)))).*(1./(2.*pi)));
fplot(wnl,[dmin dmax], 'g', 'Linewidth', 1.5)
grid on;
hold on;
plot(davg,wnl(davg), 'ko', 'Linewidth', 1.5)
wnl_lavg = wnl(2.84)

wnlmax = @(dia) (((b1l./lmax).^2).*sqrt((E.*((pi.*(dia.^4))./(64)))./(rho.*(1./(32.2.*12)).*(pi.*(dia.^2))./(4)))).*(1./(2.*pi)));
fplot(wnlmax,[dmin dmax], 'b', 'Linewidth', 1.5)
plot(davg,wnlmax(davg), 'ko', 'Linewidth', 1.5)
wnl_lmax = wnlmax(2.84)

wnlmin = @(dia) (((b1l./lmin).^2).*sqrt((E.*((pi.*(dia.^4))./(64)))./(rho.*(1./(32.2.*12)).*(pi.*(dia.^2))./(4)))).*(1./(2.*pi)));
fplot(wnlmin,[dmin dmax], 'r', 'Linewidth', 1.5)
plot(davg,wnlmin(davg), 'ko', 'Linewidth', 1.5)
wnl_lmin = wnlmin(2.84)

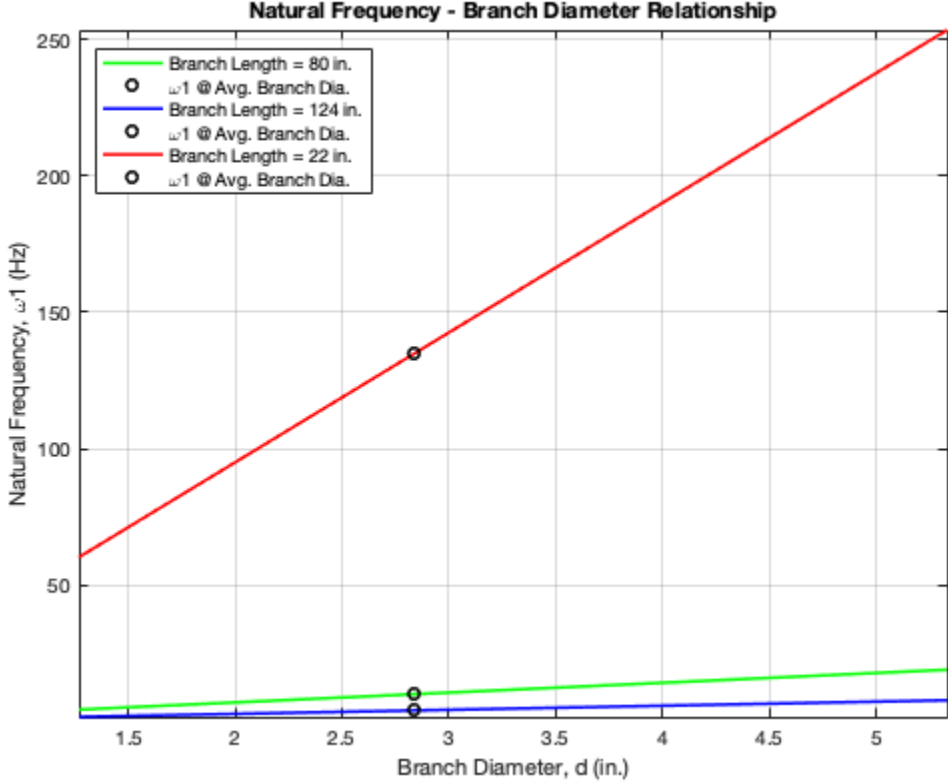
title("Natural Frequency - Branch Diameter Relationship")
xlabel('Branch Diameter, d (in.)')
ylabel('Natural Frequency, \omegal (Hz)')
legend("Branch Length = " +lavg+ " in.", "\omegal @ Avg. Branch Dia.", "Branch Length = " +lmax+ " in.", "\omegal @ Avg. Branch Dia.", "Branch Length = " +lmin+ " in.", "\omegal @ Avg. Branch Dia.")
legend('Location', 'northwest')

wnl_lavg =
    10.2098

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$wn1\_lmax =$   
4.2497  
 $wn1\_lmin =$   
135.0055



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% Beam in Transverse Vibration
% Natural Freq. v. Branch Length

b1l = 1.87510407; %From Table 6.6 (pg.539, Vibration Textbook)
lavg = 80; % Avg. Length of Branch (in.)
lmin = 22; % Min Length of Branch (in.)
lmax = 124; % Max Length of Branch (in.)
E = 2086e3; % Young's Modulus (lb/in^2)
rho = 0.0298; % Density (lbm/in^3)
davg = 2.84; % Avg. Branch Diameter (in.)
dmin = 1.27; % Min Branch Diameter (in.)
dmax = 5.33; % Max Branch Diameter (in.)

I = ((pi.*(davg.^4))./(64)); % Moment of Inertia (in^4)
A = ((pi.*(davg.^2))./(4)); % Cross-Sectional Area (in^2)

Imax = ((pi.*(dmax.^4))./(64)); % Moment of Inertia (in^4)
Amax = ((pi.*(dmax.^2))./(4)); % Cross-Sectional Area (in^2)

Imin = ((pi.*(dmin.^4))./(64)); % Moment of Inertia (in^4)
Amin = ((pi.*(dmin.^2))./(4)); % Cross-Sectional Area (in^2)

wlrads = ((b1l./lavg).^2).*sqrt((E.*I)./(rho.*(1./(32.2.*12)).*A));
w1Hz = wlrads.*(1./(2.*pi));

figure (1)
wnl = @(length) (((b1l./length).^2).*sqrt((E.*I)./(rho.*(1./
(32.2.*12)).*A))).*(1./(2.*pi)));
fplot(wnl,[lmin lmax], 'g', 'Linewidth', 1.5)
grid on;
hold on;
plot(lavg,wnl(lavg), 'ko', 'Linewidth', 1.5)
wnl_davg = wnl(80)

wnlmax = @(length) (((b1l./length).^2).*sqrt((E.*Imax)./(rho.*(1./
(32.2.*12)).*Amax))).*(1./(2.*pi)));
fplot(wnlmax,[lmin lmax], 'b', 'Linewidth', 1.5)
plot(lavg,wnlmax(lavg), 'ko', 'Linewidth', 1.5)
wnl_dmax = wnlmax(80)

wnlmin = @(length) (((b1l./length).^2).*sqrt((E.*Imin)./(rho.*(1./
(32.2.*12)).*Amin))).*(1./(2.*pi)));
fplot(wnlmin,[lmin lmax], 'r', 'Linewidth', 1.5)
plot(lavg,wnlmin(lavg), 'ko', 'Linewidth', 1.5)
wnl_dmin = wnlmin(80)

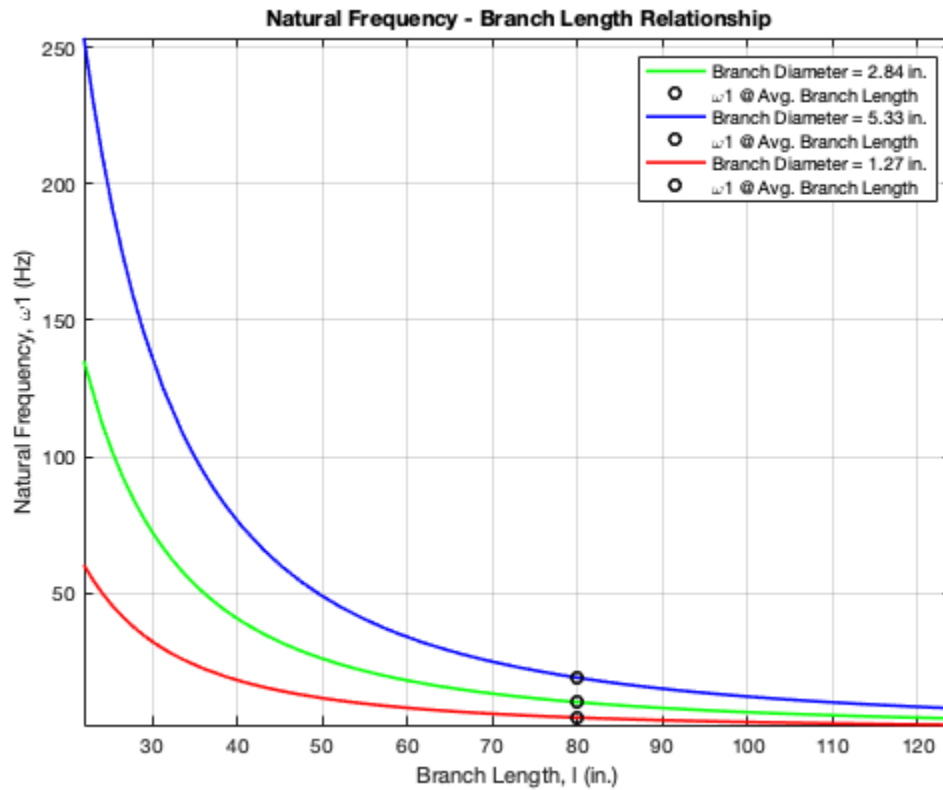
title("Natural Frequency - Branch Length Relationship")
xlabel('Branch Length, l (in.)')
ylabel('Natural Frequency, \omega_1 (Hz)')

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```
legend("Branch Diameter = " +davg+ " in.", "\omegal @ Avg. Branch  
Length", "Branch Diameter = " +dmax+ " in.", "\omegal @ Avg. Branch  
Length", "Branch Diameter = " +dmin+ " in.", "\omegal @ Avg. Branch  
Length")
```

```
wn1_davg =  
    10.2098  
wn1_dmax =  
    19.1613  
wn1_dmin =  
    4.5656
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