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% C. Talarico - polezero.m
% 3D plot of transfer function magnitude
% H(s) = 10*(s+2) / ((s+1)(s+3))

clear all; clc; close all;

H0 = 10;
z1 = -2;
p1 = -1;
p2 = -3;

[X,Y] = meshgrid(-4:0.1:4);
s = X + j*Y;
M = abs(H0*(s-z1)./((s-p1).*(s-p2)));

figure;
% make up a custom coloring scheme
niceblue = [0,0.4470, 0.7410];
white = [1,1,1];
surf(X,Y,M,'EdgeColor',niceblue, 'FaceColor',white, 'FaceAlpha',0.2);
grid on;
ax = gca;
ax.XAxis.FontSize = 12;
ax.YAxis.FontSize = 12;
ax.ZAxis.FontSize = 12;
xlabel('real axis', 'fontsize', 16)
ylabel('imaginary axis', 'fontsize', 16)
zlabel('Magnitude','fontsize',16);
axis([-4 0 -4 3 0 15])
view([152,12]);
titleText = ['$$ H(s) = \frac{10 \dot (s+2)}{(s+1) \dot (s+3)} $$'];
title(titleText,'Interpreter','Latex', 'fontsize',20 );
hold

% walk along the imaginary axis from 0 to 4 (Bode plot)
% i.e. make the real part = 0
X = zeros(length(X),1);
s = X + j*Y;
M = abs(H0*(s-z1)./((s-p1).*(s-p2)));
index = find(Y>=0,1);
siemensgreen = 1/255*[0,104,87];
plot3(X(index:length(X)),Y(index:length(X)),M(index:length(X)),...
     'linewidth',4,'color',siemensgreen);

% marking z1
x = linspace(0,-4,100);
y = zeros(100,1);
z = zeros(100,1);
plot3(x,y,z,'linewidth', 1, 'color', 'k', 'linestyle','-');
for i=1:100
    x(i) = -2;
end
y = linspace(0,2,100);
z = zeros(100,1);
plot3(x,y,z,'linewidth', 3, 'color', 'k', 'linestyle','-.');
text(-2.3,-0.6,0.6, "z_1 = -2", 'fontsize',14,'color','k')

% marking p1
for i=1:100
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```
    x(i) = -1;
end
y = linspace(0,2,100);
z = zeros(100,1);
plot3(x,y,z,'linewidth', 3, 'color', 'r', 'linestyle','-.');
for i=1:100
    x(i) = -1;
    y(i) = 0;
end
z = linspace(0,20,100);
plot3(x,y,z,'linewidth', 3, 'color', 'r', 'linestyle','-.');
text(-1.3,-0.6,0.6, 'p_1 = -1', 'fontsize',14, 'color','r')

% marking p2
for i=1:100
    x(i) = -3;
end
y = linspace(0,2,100);
z = zeros(100,1);
plot3(x,y,z,'linewidth', 3, 'color', 'm', 'linestyle','-.');
for i=1:100
    x(i) = -3;
    y(i) = 0;
end
z = linspace(0,20,100);
plot3(x,y,z,'linewidth', 3, 'color', 'm', 'linestyle','-.');
text(-3.5,-0.6,0.6, 'p_2 = -3','fontsize',14, 'color','m')
```

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Current plot held
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