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Bode magnmitude and phase characteristics calculator

```
clear all;
% Define the transfer function (going trough all of them):

H_a(1) = zpk([],[-3], 10);           %a)
H_a(2) = zpk([-70],[-20],0.2);       %b)
H_a(3) = zpk([0],[-7],2);            %c)
H_a(4) = zpk([], [0 -7],20);         %d)
H_a(5) = zpk([], [0 -1/7],5/7);      %e)
H_a(6) = zpk([], [-1 -10],75);       %f)
H_a(7) = zpk([-2],[-1/3 -1/2], 2/6); %g)
H_a(8) = zpk([-1/10],[-1/3 -1/2], 2*10/6); %h)
H_a(9) = zpk([-2],[-5, -10], 20);    %i)

for id = 1:9
H = H_a(id);
% define the freq. boundaries (1ex):
wmin = -1;
wmax = 3;

% Reading the zeros and the poles:
z = abs(cell2mat(H.Z));
p = abs(cell2mat(H.P));

% Calculating the gain:
% Function calculating the gain:

k = k_cal(H,z,p);

% Calculating the freq. of the approximation points:
wma = wma_cal(z,p,k, wmin, wmax);
%Calculating the magnitudes of the approx. points:
m = zeros(length(wma)-1,1);
[m,wma] = mag_cal(wma,m,k);

% Ploting the magnitudes and the phases:
plot_app(H,wma,m);

end
```

Functions:

```
% Function calculating the gain:
function k = k_cal(H,z,p)
    if length(z) ~= 0
        for i = 1:length(z)
            if z(i) == 0
                z_k(i) = 1;
            else
```

```

        z_k(i) = z(i);
    end
end
else
    z_k = 1;
end

if length(p) ~= 0
    for i = 1:length(p)
        if p(i) == 0
            p_k(i) = 1;
        else
            p_k(i) = p(i);
        end
    end
else
    p_k = 1;
end

k = H.K*prod(z_k)/prod(p_k);

end

% Function for obtaining wma
% (Doing some magic to get wma matrix with more info)
function wma = wma_cal(z,p,k, wmin, wmax)
    aux = wmin:wmax;
    wma = 10.^aux;
    wma = [wma' zeros(length(wma),1)];

    %adding zeros and poles to wma
    z = [z ones(length(z),1)];
    p = [p ones(length(p),1)*(-1)];
    zap = [z; p];
    zap = sortrows(zap);

    wma = [wma ; zap];
    wma = sortrows(wma);

    for i = 1:length(wma)-1
        if wma(i,1) == wma(i+1,1)
            if wma(i,2) == 0
                wma = [wma(1:i-1,:); wma(i+1:end,:)];
            else
                wma = [wma(1:i,:); wma(i+2:end,:)];
            end
            break
        end
    end
end

end

% Function calculating the magnitudes:
function [m,wma] = mag_cal(wma,m,k,type)
    if wma(1,1) == 0
        coeff = wma(1,2)*20;
    end
end

```










