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% Chebyshev High-Pass Filter using
% Example 5-3 p 229 as a Low-Pass
% Filter Prototype

close all; % close all opened graphs
clear all; % clear all variables
figure; % open new graph

% Normalized components from filter coefficient tables
Ln1 = 3.3487; % Normalized Inductance
Ln2 = 3.3487; % Normalized Inductance
Cn1 = 0.7117; % Normalized Capacitance
Rg = 50; % Source resistance
RL = 50; % Load Resistance

wc=2*pi*900e6; % Cutoff Frequency of 900 MH

% Transform the normalized low-pass values
% to the normalized high-pass filter values

Cn1hp = 1/(wc*Ln1); % Normalized High-Pass C
Cn2hp = 1/(wc*Ln2); % Normalized High-Pass C
Ln1hp = 1/(wc*Cn1); % Normalized High-Pass I

% Denormalize the High-Pass Component Values

C1 = Cn1hp/Rg;
C2 = Cn2hp/Rg;
L1 = Ln1hp*Rg;

f = 1;
for i=1:4000;
    w=2*pi*f;
    ZC1=1./j*w*C1;
    ZC2=1./j*w*C2;
    ZL1=j*w*L1;
    YL1=1./ZL1;
    GL=1./RL;

    % Define the ABCD matrices for each element of the filter

    A0=[1 Rg;0 1];
    A1=[1 ZC1;0 1];
    A2=[1 0;YL1 1];
    A3=[1 ZC2;0 1];
    A4=[1 0;GL 1];

    ABCD=A0*A1*A2*A3*A4;
    freq(i)=f;
    H(i)=2.*1/(ABCD(1));

    f=f+0.002*wc/(2*pi);
end

subplot(211), semilogx(freq,20*log10(abs(H)));grid on; ylim([-50 10]);
title('3rd Order Chebyshev High-Pass Filter Response');
xlabel('Frequency, Hz');
ylabel('Attenuation, dB');

phase=atan(imag(H)/real(H));
subplot(212), semilogx(freq,phase/pi*180);grid on; xlim([1e8 1e10]);
xlabel('Frequency, Hz');
ylabel('Phase, deg.');

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