This example shows how to use time-doamin data to find s-domain impedance

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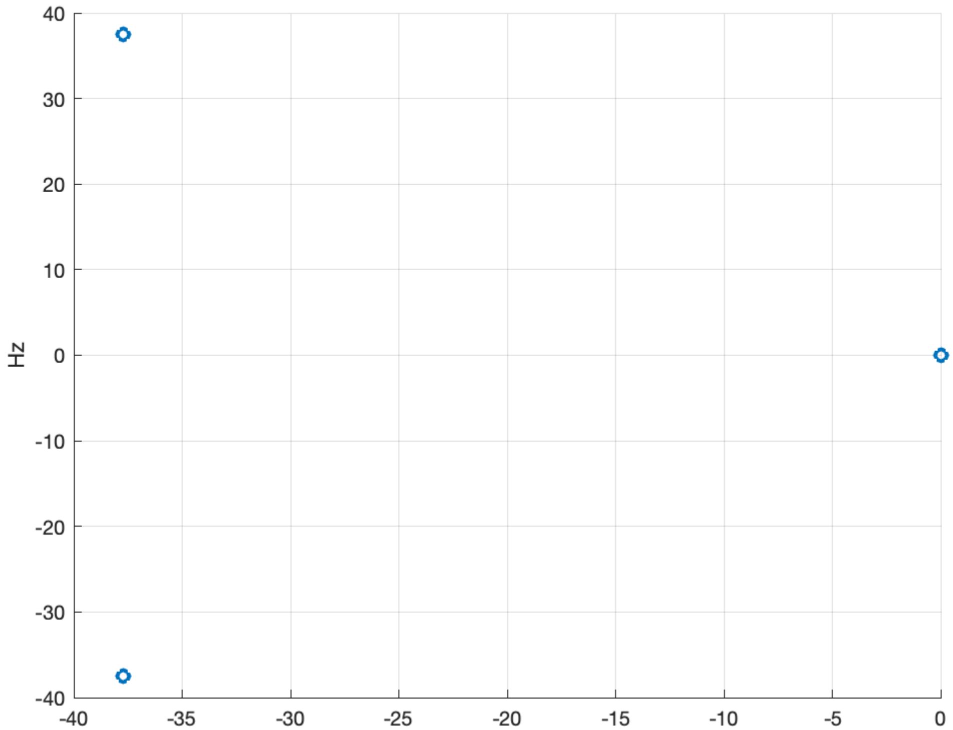
Contents

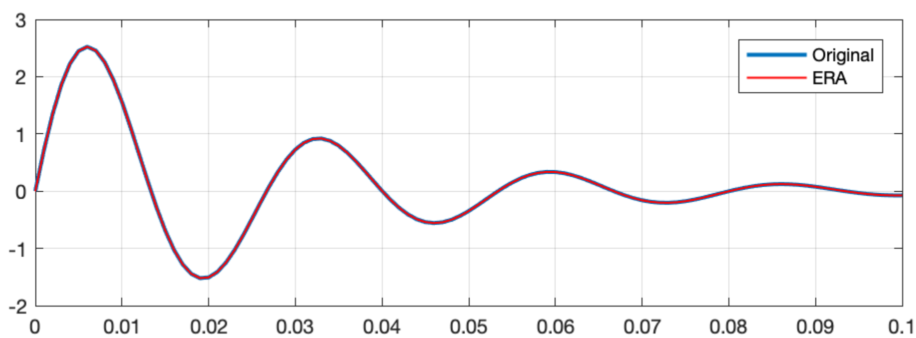
step 1: Generate time-domaind data -- step response

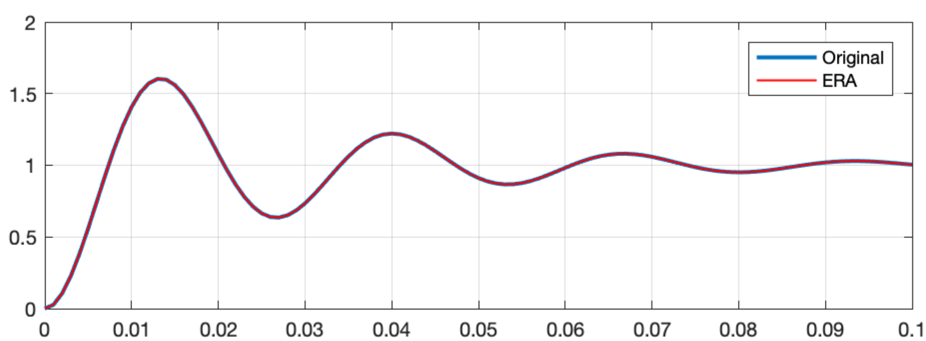
```
clear; clc;
s= tf('s');
h = 0.001;
t = 0:h:0.1;
vs = ones(length(t),1); % step excitation
R = 0.1; L = 0.5/377; C = 1/0.2/377;
sys = C*s/(R*C*s+L*C*s^2+ 1); % from vs to current
sys1 = L*C*s^2/(R*C*s+L*C*s^2+ 1); % from vs to inductor voltage.
sys2 = 1/(R*C*s+L*C*s^2+ 1); % from vs to capacitor voltage.

cur = lsim(sys, vs, t);
vl = lsim(sys1, vs, t);
vc = lsim(sys2, vs, t);
```

Step 2: run ERA to get necessary information: eigenvalues and residues

```
% we use current (cur) and capacitor voltage (vc) as two output signals.
% the input signla is a step response.
m = 3; % order of the system can be varied.
y = [cur, vc];
[N, n_ch]=size(y);
ya = y; %+ 1.0*rand(N,n_ch)-1.0/2;

% this funciton is key. It acceptes the data as row vectors.
% 3 is the assumed system order
% h is the step size of the data
% 1 -- default value, keep it there (discrete state-space model).
[A1,B1,C1,D1, eig_s,residue1, sysdisc, HSVs]=fun_mera(ya',m ,h,1);
%syscont = d2c(sysdisc,'zoh');       % Conversion of discrete LTI models to continuous time

% the following code shows how to use MP
% eig_s =fun_msignal_MP([cur, vl], 3, h)
```



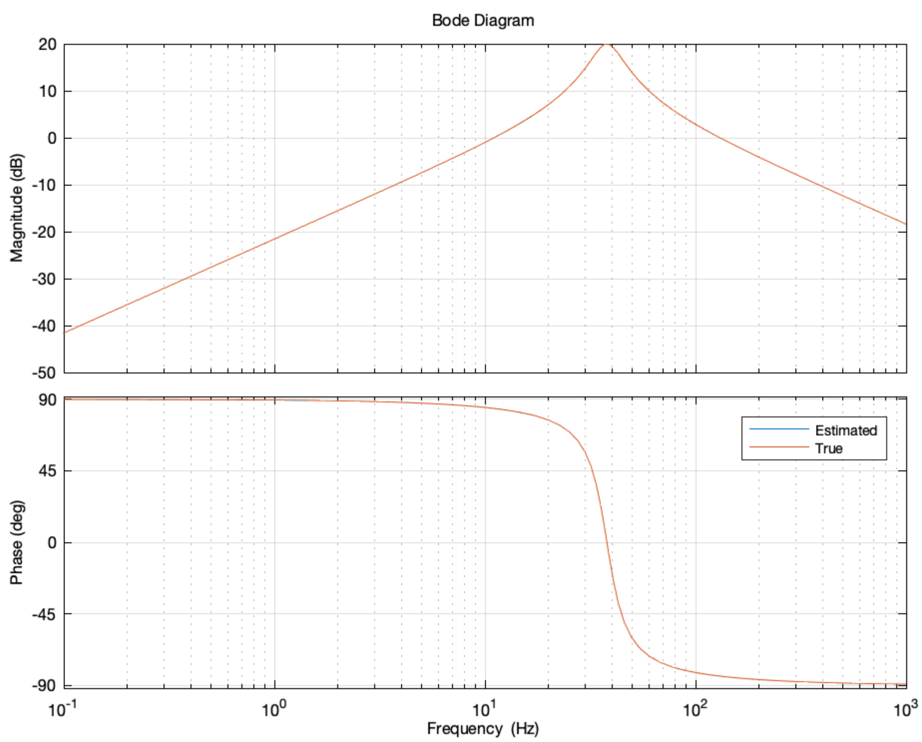




Step 3: Assemble admittance

after running step 2, we obtain eigenvalues (a column vector) and residue1 (two column vector). The first column is relevant to the current measurement.

```
res1 = residue1(:,1);
s = tf('s');

curr_s = 0;
for i=1:length(eig_s)
    curr_s = curr_s + res1(i)/(s-eig_s(i));
end
Y_s = curr_s*s; % consider the step excitation as the input

figure(1000);
bodeP = bodeoptions;
bodeP.FreqUnits = 'Hz';
bode(Y_s, bodeP); hold on; bode(sys, bodeP);
legend('Estimated', 'True');
grid on;
xlim([0.1, 1000]);
```



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