W6

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Consider the exact solution that is:

Consider the following values for the impedance and an input of 30 volts:

The unit step response looks as follows:

A graph on a white background

AI-generated content may be incorrect.

we can generate Y parameters out of this, consider the bellow table:

|  |  |
| --- | --- |
|  |  |
| 200 π | 1.0000 - 0.0005i |
| 400 π | 1.0000 - 0.0010i |
| 1000 π | 1.0000 - 0.0025i |
| 2000 π | 1.0001 - 0.0050i |
| 10000 π | 1.0014 - 0.0252i |

Using NILTcv to plot both we get.

A graph with blue and red lines

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With RMSE of 5.3425.

* Now let’s consider 3 Y parameters and combine them.
* First lets change the code for generating the Y parameters :
* Generate Y parameters out of these values:

Consider n=3:

At

Re-write this as:

Then,

clear

clc

% Given the last 3 points

Yr = [0.2485, 0.2166, 0.1546]; % Real part of Y11

Yi = [-0.0195, -0.0848, -0.1210]; % Imaginary part of Y11

w = [1000\*pi, 5000\*pi, 10000\*pi];

A = [];

C = [];

% Loop through each frequency point to construct A and C

for k = 1:length(w)

wk = w(k);

Yr\_k = Yr(k);

Yi\_k = Yi(k);

% Construct rows for A and C

A\_row1 = [-1, Yr\_k, 0, -wk\*Yi\_k, wk^2, -Yr\_k\*wk^2]; % Real part

A\_row2 = [0, Yi\_k, -wk, wk\*Yr\_k, 0, -Yi\_k\*wk^2]; % Imaginary part

% Append to A

A = [A; A\_row1; A\_row2];

% C

C\_row1 = -wk^3 \*Yi\_k ; % Real part

C\_row2 = wk^3 \* Yr\_k; % Imaginary part

% Append to C

C = [C; C\_row1; C\_row2];

end

% Solve for B = [a0; b0; a1; b1]

B = A \ C;

% get cof

a0 = B(1);

b0 = B(2);

a1 = B(3);

b1 = B(4);

a2 = B(5);

b2 = B(6);

f = 0:100:10000;

w = 2\*pi\*f;

s = i\*w;

% generated H

H = (a2\*s.^2+a1\*s+a0)./(s.^3+b2\*s.^2+b1\*s+b0);

plot(f,H)

Moving on to generating Y parameters for the transmission line.

This is how the transmission line above looks like when s = jw as to the one approximated.

A graph of a graph

AI-generated content may be incorrect.

We can see that it almost matches the exact at low frequencies, but at high frequencies, it remains stable without an exact match. Therefore, we need to develop another model to accurately match the first section within the frequency range of 2.5×10^5 to 4.8×10^5.

Now, let’s generate a y model for the frequencies above:

A graph of a function

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Now, let’s try to combine these 2 approximations.

If we just simply add the two H1+H2, the result will look like this compared to the exact:

A graph on a white sheet

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This is better in the shape but not accurate,

How can we add the two models and consider the first one for low frequency (i.e stable range ) and the second one for lets say high frequency (e.g.2.5x10^5:4.8x10^5) because the combined when s=jw seems better.

A graph of a graph

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