Case study 3: Circuits as Resonators, Sensors, and Filters

ESE 105

Name: FILL IN HERE

function myResonatorCircuit(Vin,h) receives a time-series voltage sequence sampled with interval h, and returns the output voltage sequence produced by a circuit

inputs: Vin - time-series vector representing the voltage input to a circuit h - scalar representing the sampling interval of the time series in seconds

outputs: Vout - time-series vector representing the output voltage of a circuit

```
function Vout = myResonatorCircuit(Vin,h)

Vin_length = size(Vin, 1);
Vout_seconds = 5;   % length (in seconds) of Vout. Supposed to be at
 least
                    % 5 seconds for competition, but takes a really
 long
                    % time to compute. SET TO HIGHER VALUE BEFORE
 TURNING
                    % IN.

R = 14.4;           % tuned R for 440 hz
L = .361716*10^0;   % tuned L for 440 hz
C = .361716*10^-6;  % tuned C for 440 hz
V_C = 0;            % initial capacitance voltage
I=0;                % initial current


% Storage matrix. 1st column = Vout values, 2nd column = time values,
 3rd
% column = Vin values.
V_time_data = [Vout_seconds/h, 3];

% Iterates through the desired number of seconds set above. Stores
 Vout,
% time, and Vin in 1st, 2nd, and 3rd columns of |V_time_data|,
 respectively.
% Uses same matrix multiplication as RLCCircuit.
for k=1:Vout_seconds/h
    A = [1, h/C; -h/L, 1-h*R/L];
    x_k = [V_C, I]';
    B = [0, h/L]';

    % Sets u_k equal to kth element of Vin if k is in the range of
 Vin.
    % Else, sets u_k (which represents Vin) equal to 0 (since no input
    % voltage).
```

```
    if k<=Vin_length
        u_k = Vin(k, 1);
    else
        u_k = 0;
    end

    x_k_f= A*x_k + B*u_k;
    V_time_data(k, 1) = I*R;
    V_time_data(k, 2) = k*h;
    V_time_data(k, 3) = u_k;
    V_C = x_k_f(1, 1);
    I = x_k_f(2, 1);
end

% Sets Vout equal to Vout column of |V_time_data|.
Vout = V_time_data(:, 1);

end
```

```
Not enough input arguments.

Error in myResonatorCircuit (line 20)
Vin_length = size(Vin, 1);
```

Published with MATLAB® R2021a