

# ECE 45 – Circuits and Systems Spring 2023

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## Homework #2

**Due: January 16 at 11:59pm, submitted via GradeScope.**

You can make multiple upload attempts to experiment with the system and the best way to upload. You must correctly mark the answers to the problems in GradeScope, e.g. problem 1, problem 2, problem 3, to get full credit. Note that you must tag your problems when uploading to GradeScope or they will not be graded and you will not receive credit. Any regrade requests must be placed through GradeScope within one week of the return of the homework.

Remember, discussion of homework questions is encouraged. Please be absolutely sure to submit your own independent homework solution.

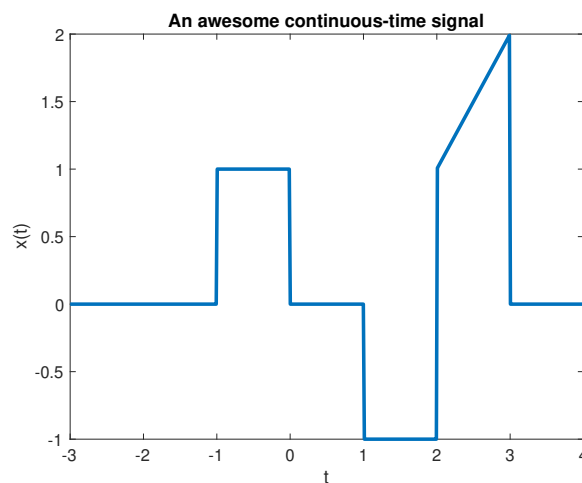


Figure 1: A continuous time function,  $x(t)$ .

1. The signal  $x(t)$  is shown in Fig. 1. Sketch carefully each of the following signals. The values not shown are zero.
  - (a)  $x(t - 1)$
  - (b)  $2x(2 - t)$
  - (c)  $x(3t - 1) + 1$
  - (d)  $x(t/3 - 1) + 1$
  - (e) Even part of  $x(t)$
  - (f) Odd part of  $x(t)$
  - (g)  $x(t)u(t)$
2. Sketch carefully each of the following signals.

- (a)  $2\text{rect}(3t - 2)$
- (b)  $\text{rect}(t - 1/2) + \text{rect}(t + 1/2)$
- (c)  $\text{rect}(t)u(t)$

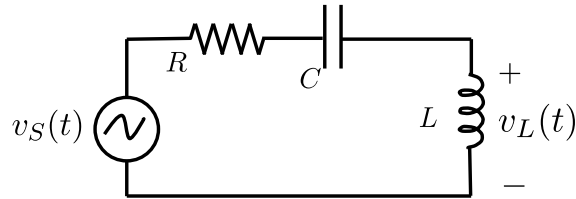


Figure 2: Revisiting the RLC circuit

3. Consider the circuit shown in Fig. 2. Let  $v_S(t)$  denote the input voltage signal and let  $v_L(t)$  denote the output measured voltage signal. Using the phasor method with  $v_S(t) = A \cos(\omega t)$  answer the following questions.
  - (a) Find  $\mathbf{V}_S$
  - (b) Find the effective impedance that relates  $\mathbf{V}_L = \mathbf{Z}_E \mathbf{V}_S$
  - (c) Find  $\mathbf{V}_L$
  - (d) Find  $|\mathbf{Z}_E|$
  - (e) Find the phase of  $\mathbf{Z}_E$
  - (f) Compute  $v_L(t)$
4. Using the provided **MATLAB script** as a template, recreate the answer to the Problem 1. Note that your script should output the figures with proper labeling and formatting. You do not need to have the corresponding text outputs. You will create a PDF of your MATLAB script, PDFs of your figures and submit them all together to GradeScope along with your homework.
5. Using the provided **MATLAB Live script** as a template to solve again the previous problem. You mainly have to copy your previous solution in the correct places, to get an understanding about how MATLAB Live works versus scripts. MATLAB Live is a computational notebook, similar to a Jupyter notebook as commonly used in Python. These notebooks are a way of mixing text, equations and code. They are very popular in the machine learning research community as a convenient way of sharing code. You can find more information about MATLAB live scripts here:

[https://www.mathworks.com/help/matlab/matlab\\_prog/create-live-scripts.html](https://www.mathworks.com/help/matlab/matlab_prog/create-live-scripts.html)

You will create a PDF of your MATLAB live script and submit it to GradeScope along with your homework.

6. Correct your previous week's homework using a colored pen (or annotation) so it's obvious what you've corrected. If you got a problem exactly right, just use a red check mark to indicate as such.