An Integrated Framework for the Grading of Freeform Responses

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edX
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Understand learning

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LAB 9: SECOND-ORDER CIRCUITS

In this lab we’ll be exploring the properties of second-order circuits, i.e., circuits with two energy storage elements. You may find it useful to review Chapter 12 in the text.

Figure 1 below shows the circuit we’ll be using to explore the step response of an RLC circuit. The voltage source produces a 1V step at t = 0. Initially the resistor has been set to 0Ω. We’ll be probing the voltage across the capacitor, which will indicate the amount of charge on the plates of the capacitor (q = CΔv), and the current through the inductor, which will indicate the flux linkage of the magnetic field of the inductor (Δ = Li).

![Circuit Diagram]

A voltage step oscillates back and forth between the flux of the inductor and the charge oscillating current through the inductor.

The oscillation is 100 kHertz with a period of 10 μs. You can use (12.45) to compute the correct value for C given L. v(ωt) = 1 Hz to radians/sec using $1 Hz = 2\pi rad/ sec$.

Keeping the adjusted C, now adjust the resistance R so that the system is just operating in the under-damped region, i.e., so that the voltage across the capacitor makes a single 0 → 1 transition, never exceeding 1V. Again you can use the analysis in Section 12.2.2 to compute the R necessary to produce a plot like that to the right. Hint: if there’s any voltage sample that is greater than 1V, the voltage scale will have a maximum of 2V. If the plot is staying less than 1V, lower the maximum voltage scale to 1V.

Please enter the adjusted resistance R below:

Adjusted resistance R (in ohms):

Now let’s use the properties of second-order systems to build a boost converter, a DC-to-DC power supply useful where high voltages are required but not directly available. Powering the flash bulb in a camera is one such example. A boost converter circuit is shown in Figure 2. In this case the supply voltage is 3V and the goal is produce a relatively stable supply of 6V to drive a load, here represented as a 1Ω resistor. Your task is to adjust L, C and the duty cycle D of the square wave controlling the MOSFET switch so that the output voltage falls between 5.9V and 6.1V (with a maximum of 0.1V ripple).
Remaining Problems

Short answers
Forum posts
Essays
Pictures
Videos
...
Approaches
Approaches

Portfolios
Artificial intelligence
Self-assessment
Peer assessment
Instructor/TA
Approaches

Portfolios
Artificial intelligence
Self-assessment
Peer assessment
Instructor/TA
Goals

Maximize accuracy of assessment

Minimize cost (where grading can be a hassle)
Framework

Diagram of an integrated framework for grading freeform responses.
Implementation
Self Assessment

- Self assessment allows students to answer a question, see a rubric, and rate themselves.
  - Requires no grading effort from course staff.
  - Particularly valuable in learning sequences where the goal is to learn by constructing knowledge.
AI Assessment

- A computer algorithm scores student submission.
  - Machine Learning (ML) creates a model using 100 course staff graded responses.
  - This model is used to automatically grade students.
  - For many problems, similar to course staff grading each student individually, but with much less effort.
Peer Assessment

- Peer assessment involves students giving each other scores and feedback
  - Significant pedagogical value for both the student being graded and the grader.
  - Graders first learn how to grade the problem by looking at instructor graded examples.
  - Features such as smart peer matching and user flagging of inappropriate submissions address concerns with previous online peer grading implementations.
Flexible Assessment Types

- Any of the previous 3 assessment types can be used together.
  - A single student response can pass through any combination of graders.
  - For example, a response could be self-assessed, then ML graded. If the two mismatch, peer grading can be used to confirm.
# Current Student Problem Interface

## STUDENT SUBMISSION

**HUMANITIES QUESTION – MACHINE ASSESSED**

**Prompt:** What role should libraries play in spreading knowledge?

**Response:** Libraries are a critical resource in disseminating information. They provide access to a vast array of resources, including books, magazines, and online databases. Libraries also serve as community centers where people can gather to learn and grow. In today's digital age, however, the role of libraries is evolving. While they still offer a physical space for reading and studying, libraries are also playing an increasing role in providing digital resources and services. In this sense, libraries are not just places for acquiring knowledge, but also for sharing it. Libraries are thus playing an integral role in spreading knowledge and promoting literacy.

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## STUDENT SELF-ASSESSES

**HUMANITIES QUESTION – MACHINE ASSESSED**

**Prompt:** What role should libraries play in spreading knowledge?

**Response:** Libraries are important in spreading knowledge because they provide a space for reading and learning. They also offer a wide range of resources, such as books, newspapers, and journals, that can help people gain knowledge.

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## EXTERNAL GRADER RESULTS

**HUMANITIES QUESTION – MACHINE ASSESSED**

**Prompt:** What role should libraries play in spreading knowledge?

**Response:** Libraries are important because they provide a place for people to learn and read. They also offer a wide range of resources, such as books and journals, that can help people gain knowledge.

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**Rubric**

- **Writing Applications:**
  - 3 points: The essay is clear, and the thesis is well-supported.
  - 1 point: The essay is unclear, and the thesis is not well-supported.

- **Language Connections:**
  - 3 points: The essay demonstrates a good understanding of the topic.
  - 1 point: The essay demonstrates a poor understanding of the topic.

**Score:** 3/5

**Feedback**

- Writing Applications: Improve the clarity of the essay.
- Language Connections: Improve the understanding of the topic.

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![Image of a library with books and people]

*Image Description:*

- A library with a variety of books on display.
- People reading and studying in the background.

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**Note:**

- The prompt for the essay is: What role should libraries play in spreading knowledge?
- The rubric for the essay is as follows:
  - **Writing Applications:**
    - 3 points: The essay is clear, and the thesis is well-supported.
    - 1 point: The essay is unclear, and the thesis is not well-supported.
  - **Language Connections:**
    - 3 points: The essay demonstrates a good understanding of the topic.
    - 1 point: The essay demonstrates a poor understanding of the topic.

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**External Grader Results**

- **Prompt:** What role should libraries play in spreading knowledge?
- **Response:** Libraries are important because they provide a place for people to learn and read. They also offer a wide range of resources, such as books and journals, that can help people gain knowledge.

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**Rubric**

- **Writing Applications:**
  - 3 points: The essay is clear, and the thesis is well-supported.
  - 1 point: The essay is unclear, and the thesis is not well-supported.

- **Language Connections:**
  - 3 points: The essay demonstrates a good understanding of the topic.
  - 1 point: The essay demonstrates a poor understanding of the topic.

**Score:** 3/5

**Feedback**

- Writing Applications: Improve the clarity of the essay.
- Language Connections: Improve the understanding of the topic.

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**Image Description:**

- A library with a variety of books on display.
- People reading and studying in the background.
Current/Future Status
Questions?