

Technical Graphing Tool with Automated Assessment Capability

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Introduction

This is a multi-semester project to develop a web-based graph entry system with automatic assessment capability, and to test that system to determine its potential usefulness.

This type of system has a very large potential impact on education. Students could greatly benefit from additional experience graphing advanced waveforms. This project will determine whether this is type of system is needed, and how beneficial it is to student learning.

Two main motivations for this project are:

- There is currently no system like this of which we know.
- Computer-assisted learning often helps in other areas, such as learning basic mathematics, foreign language, or physics, thus it is likely it will work here.

Parts of this project build upon an already existing tool for computer-assisted circuit analysis, developed by Dr. Skromme. This tool has been very successful in lab tests.

Potential Pedagogical Uses

This type of system can be used to further research into student learning methodologies. For example, information gathered from student usage of this system could help determine:

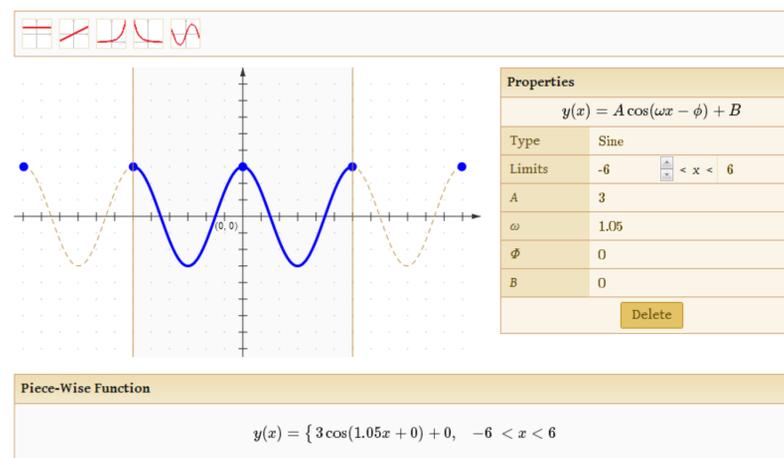
- What are common errors students make?
- Can this system help correct those common errors?
- What types of graphs are hardest for students to conceptualize?
- Is integrating or differentiating a graph easier than a mathematical function?

Work Completed

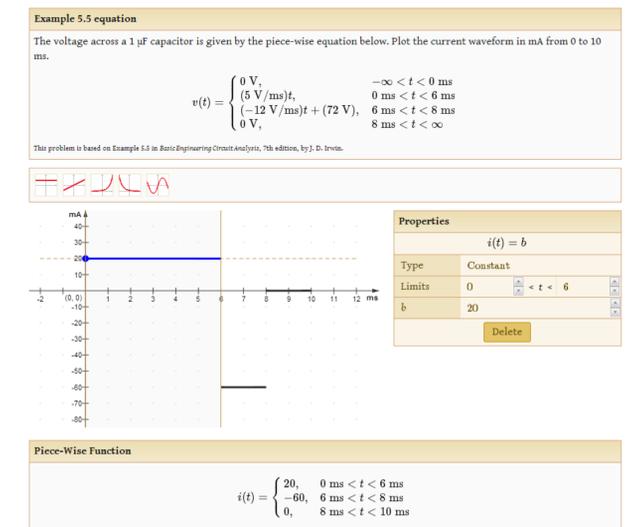
Background research was performed to determine the types of waveforms most often encountered by first- and second-year engineering students, and thus the most important features of the system were determined, and problems for testing were created.

A prototype of the system was created, allowing the student to draw piecewise graphs of arbitrary length. Graphs can be manipulated visually or numerically, allowing for numerical problems or conceptual problems. The prototype uses HTML5 and Canvas, the latest in web technologies, for the visual display. The back-end, which handles the raw data, uses PHP and MySQL, industry-standard server languages used by websites like Facebook.

The system is capable of presenting some problem to a student that requires a graph as an answer. It can then check that the student drew the correct graph as an answer. It can also display the piecewise function of the entered graph to the student.



A sinusoid with its piece-wise function



User interface as of November 13, with a problem statement, correct answer, and piece-wise function

Future Work

Future work will include:

- Continued expansion of the system
- Student testing in classes or labs
- Integration with other systems

Results

Feedback from students has been positive, and this type of system is desired by many high-performing students with whom we have spoken. Students desire large numbers of problems that are automatically graded without errors, and more importantly, instant feedback and solutions to every problem. A system like this could provide this, with little or no additional work by the instructor. Actual classroom testing will give us more detailed information.