Circuit Planner App

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Contents

Stating the problem

The problem

GCSE physics students in DGSB require knowledge of circuits as part of their course, but unfortunately the physical equipment to teach many of these circuits is expensive, limited in the school, is easily broken, and home learning is not possible as equipment cannot be taken outside of school. Most students simply learn about these circuits from an image in a textbook.

Justification for computational solution

The physics calculations are an ideal fit for a computational solution. This is because the amount of maths required is significant, so would be time-consuming for anybody to do to just demonstrate the physics.

These calculations are not required by GCSE level physics, so would be difficult to be shown manually by a teacher who does not need to know or explain the equations. Showing the values of current and voltage at any point is sufficient at GCSE level.

There will be a high level of abstraction, inheritance and polymorphism, as this is needed for a hierarchy of components, with one base component extending off into a dozen other components.

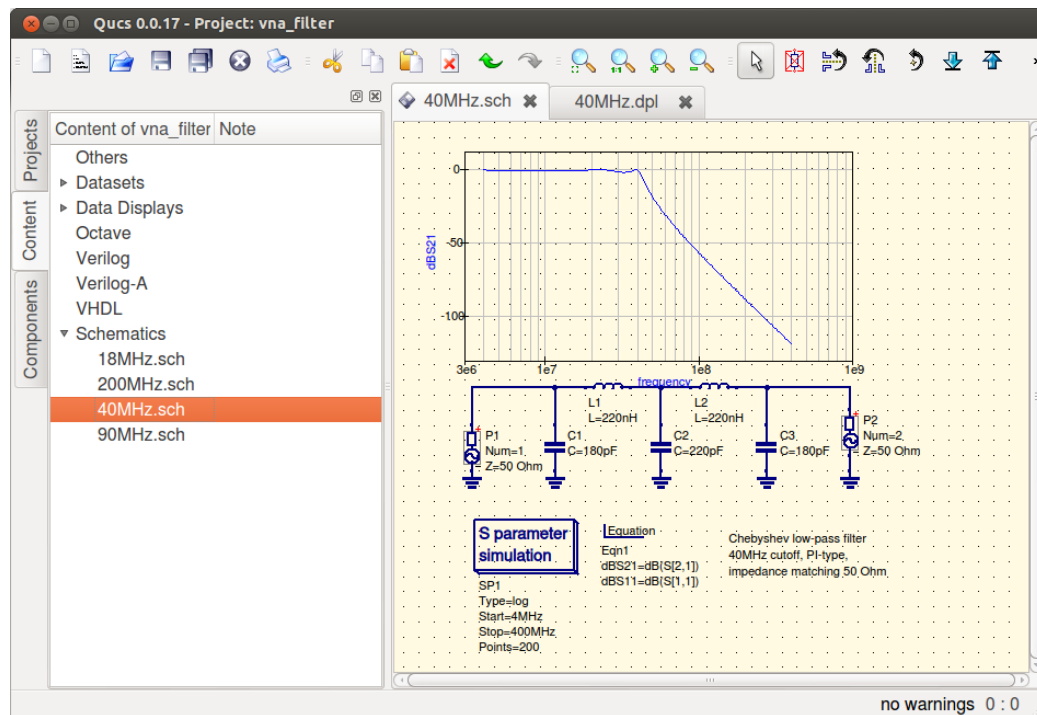# Analysis

Existing Solutions

Qucs

Figure 1: qucs

What I Like:

- GUI program, not CLI.

- Drag & drop of components onto a canvas.

- Can import/export circuits.

- Can simulate circuits.

What I Dislike:

- Massively complicated - menus inside menus with buried functionality.
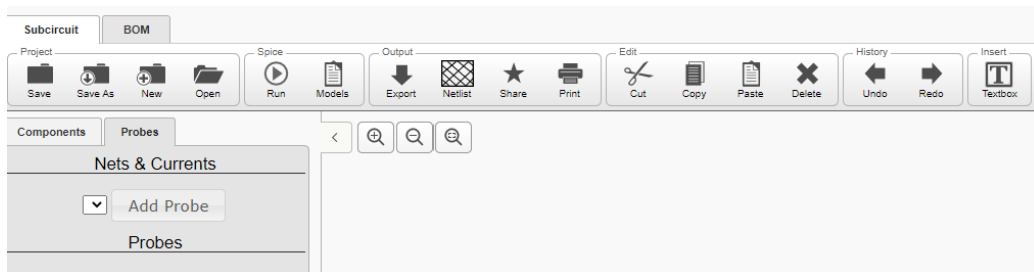- Unsuitable for students - many components irrelevant to the GCSE.

Partsim

Figure 2: partsim

What I Like:

- Has less menus than QUCS, is easier to navigate.
- Can import/export circuits.
- Can simulate circuits.

What I Dislike:

- It is a web app, so is not native and uses up a lot of computing power.
- It is made for companies, not students.
- Too many components irrelevant to the GCSE.

Paper-based

What I Like:

- Much better for teaching students
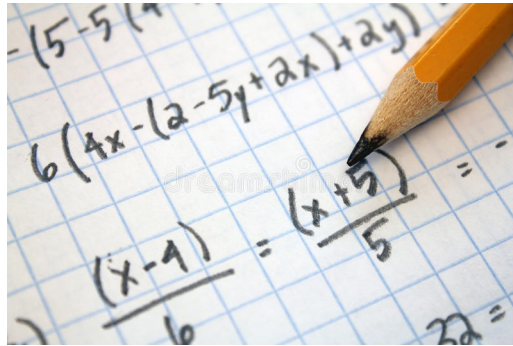- Shows all the calculations.

Figure 3: paper

What I Dislike:

- Some required calculations are not needed for the GCSE, so the students would need to learn lots of irrelevant equations.

- Takes a long time to work out larger circuits.

- Can have errors that will be taken forward.

Research Questions

For physics teachers:

1. Are you currently satisfied with the electronics equipment in school?

2. Would you feel comfortable teaching students electronics with a computer program?

3. Do you feel it would be beneficial to be able to send students assignments to make circuits at home on this program?

4. Would you agree that students would understand theories better if they were given an example of the theories working? E.g. seeing the current splitting between a parallel circuit.

5. Do you feel that a program that can be used on personal devices would be a helpful aid for home learning?

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For physics students:

1. Are you currently satisfied with the electronics equipment in school?

2. Do you think that being able to experiment with cicuits at home would aid in your learning?

3. Would you say that you understand theories better if they were given an example of the theories working?

Hardware Requirements

Mac OSX:

- Mac OSX 10.10 or greater.
- 64 bit.
- 4 GB RAM

Windows:

- Windows 7 or greater.
- 64 bit.
- 4 GB RAM

Linux:

- RHEL 7 or equivalent.
- 64 bit.
- 4 GB RAM