Educational Simulator of Electric Circuits Using Game Engines

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Introduction

Many students in electrical and computer engineering find it difficult to comprehend and undertake steps to simplify electric circuits. The purpose of this simulator was to pave the way into developing a program which imitates the way that circuits work and allows students to create and interact with them to understand how they can be simplified. The interface of the program was also to be designed to be visually attractive to provide a more engaging experience for students.

unity

The Design

The tool was to be made in a manner which allows students to not only work with instructor provided circuits, but also be able to create their own in a non-technical manner. As a base product this meant that the program must be capable of:

- Providing a way of interpreting user created text files into graphical circuits on screen.
- Being able to analyse any circuit to view possible simplifications.

A derivative of Spice – The circuit analyser – SpiceSharp was integrated into Unity to allow for validating which simplifications were valid.

N	Wh	Rh12	Wh	N	Wh	Rh11	Wh	N
x	x	x	x	x	x	x	x	Wv
x	x	N	Wh	Rh16	Wh	Wh	Wh	N
x	x	Wv	x	x	x	x	x	Wv
N	Wh	N	Wh	Rh19	Wh	Wh	Wh	N

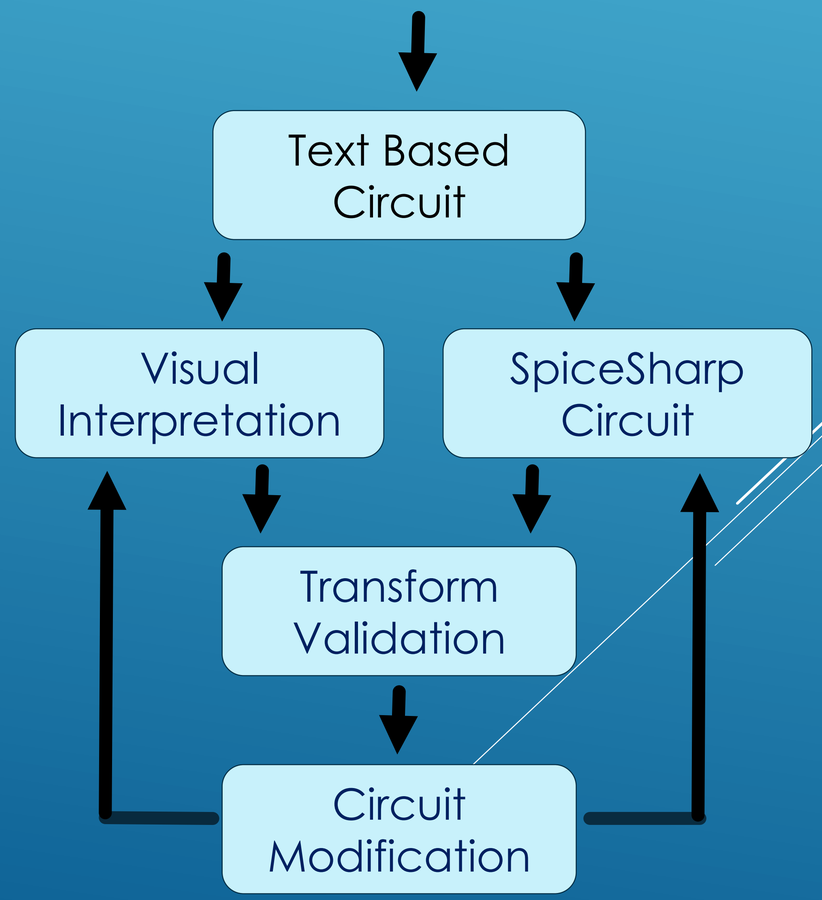

Figure 1 – Circuit Manipulation Logic

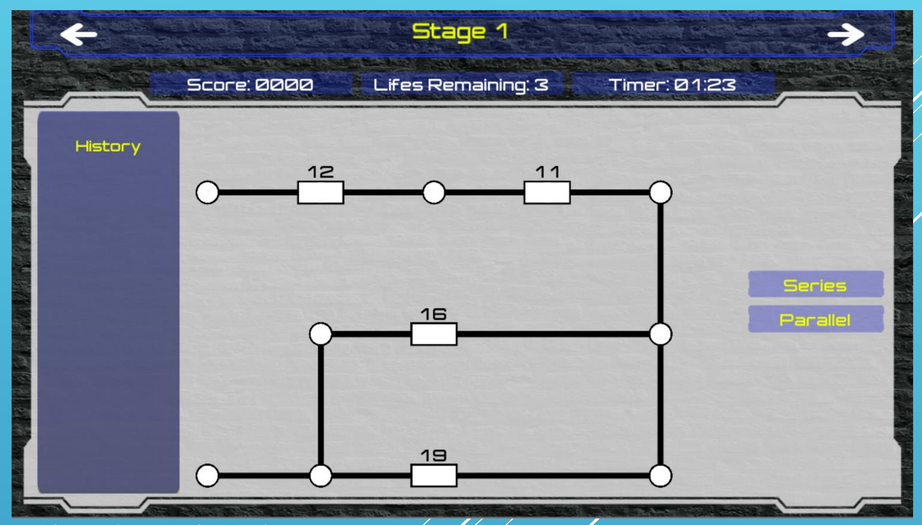

Figure 2 – Level 1 Design

Conclusions and Future Work

The work towards this project so far has provided a way for students to develop and solve their own circuits by creating a grid structure in a text file. The program works to identify which parallel/series simplifications are valid, regardless of the input circuit.

Further work needs to be done to use the integrated SpiceSharp analysis tool to identify delta-y and y-delta transforms and appropriately handle them too.

References

Sven Boulanger, SpiceSharp, (2018), GitHub repository, https://github.com/svenboulanger/SpiceSharp

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