Calculation of Current Strength Software in Closed Circuits

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Abstract. Strong currents can flow in a closed circuit. Calculation of current strength involves calculating the voltage source, resistance to the circuit, and circuit resistance. Kirchhoff's Law I and II can be applied to calculate current and voltage strength in a closed circuit. The obstacle in calculating using Kirchhoff's law is if the number of loops is large so it requires many mathematical equations. The results of this study are the program that can perform calculations in a closed circuit consisting of one and two loops with two voltage sources, five main obstacles, and two internal obstacles. The value of the resistance itself can be determined by inputting the color code on the resistor rings. In addition, an explanation of how to calculate with the law I and II Kirchoff is also included in the program.

1. Introduction

In a closed electrical circuit if there is a source voltage, the electric current will flow. The law that applies in a closed circuit is Kirchhoff's II law. Kirchhoff's second law of voltage states that the number of algebraic changes in voltage surrounding a closed circuit is zero [1][2]. In an electric circuit (consisting of voltage sources and components), Kirchhoff's Laws will apply. This law consists of the voltage of Kirchhoff or KVL and Kirchhoff's current law (Kirchhoff Current Law or KCL). Kirchhoff's law is divided into two parts, namely; Kirchhoff voltage law and Kirchhoff's current law. Kirchhoff's Voltage Law reads The number of voltage drops at each loop is zero [3].

Electric current is the flow of electrically charged particles [4][5]. In the 19th century, before electrons were discovered, electric current was determined as positively charged particles that moved from the positive pole to the negative pole of the battery. The direction of this current is called the conventional electric current direction [6]. But now it is known that the actual electric charge that moves through a conductor is electrons [7], where the direction of the flow of electrons is opposite to the direction of flow of positively charged particles if a positive charge can flow.

Calculations in closed circuits with Kirchhoff's II law require repetitive linear equations [8][9]. Many loops require linear calculations and equations that are proportional to the number of loops. Especially for compound circuits the calculation with more than one number of loops will be more difficult. Because the calculation process is quite complicated, the researcher is interested in designing a program that can do calculations for currents in closed circuits using Kirchhoff's law I and II.
2. Related Works
Application software is a subclass of computer software that utilizes the ability of a computer directly to perform a task that the user requires [10]. It is usually compared to system software that integrates various computer capabilities, but does not directly apply this ability to do a task that benefits the user[11][12]. The main examples of application software are word processors, worksheets, and media players.

3. Research Methodology
3.1. Interface Designing
The interface design is done to design the user interface for functions as mentioned above. The interface design will be done in the IDE (Integrated Development Environment) of Visual Basic 6.0.

3.2. Testing and Turn Over
Used to carry out tests on programs designed and if there are errors, corrections will be made. The method of testing the program is done by testing a number of inputs. If an error is found, the program will be debugged per line to determine errors in terms of implementation as shown in Figure 1.

3.3. Compound series
To facilitate the calculation of a compound circuit containing more than one loop, a solution strategy is needed. The following steps are needed in solving compound circuit questions.

1. Picture the electrical circuit of the compound circuit.
2. Set the current strength (symbol and direction) on each branch that is needed. Use one strong point current for the branch whose components are arranged in series. If two branches were separated from each other (not arranged in series), then the strong pointing current on the two branches must be different.
3. Simplify the arrangement of series-parallel resistors whenever possible.

![Figure 1. Steps in program design](image-url)
4. Set the following loop in the direction. Try to make the number of loops in the series as minimal as possible so that each component that is passed by at least one loop.
5. Write the equation for each loop in the series using Kirchhoff's II law.
6. Write the flow equations for each branch point using Kirchhoff's I law.
7. By using the equations in points 5 and 6, calculate the magnitudes asked.

For more details on how to calculate compound circuits using the following Kirchhoff II law, an example of a compound circuit with two loops is shown as shows in Figure 2.

**Figure 2. Example of a Two Loop Compound Series**

3.4. Form Resistor Algorithm
1. Load Form Resistor.
2. Show Form Resistor.
3. Set Picture Box 1, Picture Box 2, Picture Box 3, and Picture Box 4 to gray.
4. Fill in the combo box1.list = {Black, Brown, Red, Orange, Yellow, Green, Blue, Gray, and White}.
5. Fill in the combo box2.list = {Black, Brown, Red, Orange, Yellow, Green, Blue, Gray, and White}.
6. Perform combo box3.list = {Black, Brown, Red, Orange, Yellow, Green, Blue, Gray, and White}.
7. Perform combo box4.list = {Gold, Silver, and Colorless}.
8. If the four selected color choices do the calculation of the value of the large obstacles.
9. If you press the "OK" button, fill in the text box barriers on the main form.
10. If UpDown is shifted the value with the limit of maximum and minimum resistor values.
    If the observation can be predicted with certainly and does not require further investigation.

4. Result and Discussion
4.1. Design
The interface is a media interaction between the computer and the user. In graphical-based operating systems (graphic user interfaces or GUIs) such as Windows, the interface of software is usually a window. Through this window the user can interact with the software its uses.

The design of this program includes the placement and compilation of objects contained in the form [13]. The form that was designed in advance was made with a basic design to make it easier when making a design in Visual Basic 6.0. The program designed consists of four forms each consisting of the main form, resistor form, tutorial form, and the form about. The functions of these three forms are:
1. Main Form is a form that used to calculate closed current circuits using Kirchoff's law.
2. Form Resitor is used to select the type of resistor.
3. The Tutorial Form is used to display material from Kirchoff's law.
4. Form Menu is used to display the main menu to access the three forms above.
Two command buttons, where the first with the "OK" caption is used to close this form while moving the ring color selection results to determine the resistance value to the main text box form. The other command button is a button with the "Cancel" caption to close this form without filling the color selection results into the main text box form.
The other four combo boxes represent the fourth color of the ring, for black, brown, red, orange, yellow, green, blue, violet, black, gold, silver and colorless. The colors found on the resistor ring can be selected through this section. After the user chooses from the combo box, the picture box at the top will be colored according to the color of choice. If all four colors have been selected, the text box at the top will automatically be filled with values. The updown button is useful for shifting values according to the tolerance value of the resistor value.

4.2. Installation Method
This program does not require a special installation method, arguing that all files needed by this application can be compiled into one executable file. To install this program is copying the executable file (kirchoff.exe) into the selected folder location on the hard disk. If the program cannot be executed, do the installation by running the SETUP.EXE file.

4.3. Run Program Method
To run this program, click on the icon with the file name kirchoff.exe. After that a selection menu will appear. Select the "Theory" button to display a window on Kirchoff's law theory, the simulation button to do the calculation simulation, and the "Exit" button to exit the program [14] [15] [16].

5. Conclusion
The conclusions that can be drawn from the research that has been carried out are:
1. The program that was designed can do calculations on two loop closed circuits step by step.
2. The theory section of the program can be used as learning Kirchoff's law calculations.
3. With this program, the calculation for Kirchoff II law can be easily done both for calculations with one loop and two loops.
4. The software designed can also simulate the way Kirchoff's law works.
5. In accordance with the objectives stated in the first chapter, the aim is to make this program an alternative software for calculating current strength in a series

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