

Development of Virtual Experiment on Clipping Circuits

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Abstract

In this research paper we have formulated how experiments on Clippers are performed using the concept of virtual Intelligent SoftLab (VIS). A Combination Clipper circuit constructed using the Virtual SoftLab and observed actual outputs using VIS Model. Clipping circuits are used to remove the part of a signal that is above or below some defined reference level. VIS helps us to create results using visual display. Software for conducting the experimentations in Clipper has been developed which helps students to perform and practice the experiments. This paper explains the working of different diode clipper circuits like Positive and Negative Diode Clippers using Combinational Clipper Circuit with the help of VIS Model. A Clipper experiments provides a pictorial method of design and evaluating experiments. In this paper we have designed the software that can observe the results. This will help students in understanding working of combination Clipper. Such an implementation as regards other basic experiments is in progress.

Keywords:- Diode, SoftLab, VIS Model, Clipping Circuits, Virtual Instruments.

1. INTRODUCTION

Electronics devices and the lack of resources make us unable to perform experiments, especially when they involve sophisticated instruments [1]. Web-based and video-based courses address the issue of teaching to some extent. Conducting joint experiments by two participating institution and also sharing costly resources has always been a challenge. With the present day internet and computer technologies the above limitations can no more hamper students and researchers in enhancing their skill and knowledge [2].

The SoftLab philosophy challenges us to link the physical laboratory experiment with its theoretical simulation model within a unified and interactive environment. The goal for each instance of a SoftLab laboratory is to create a software environment where experimental research, simulation and education coexist and interact with each other. As part of the

SoftLab project, we are investigating the issues involved in the design and development of SoftLab Model for Electronics, Computer science and engineering. This paper describes how the SoftLab philosophy was used to design and implements.

The VIS forces us to address the challenge of solving experiments. Such systems require a wide range of expertise plus a flexible and diverse array of equipment. The SoftLab framework should provide the infrastructure and facilities that serve the needs for basic research.

The basic facilities include with VIS:

- High-performance graphics processors to support scientific visualization, and multimedia facilities.
- Software that allows application researchers to make full use of these facilities to evaluate their experiments without any risk.
- Virtual laboratories that provide scientists with a full range of functionality, both for experimental activities and for the mathematical modeling and simulation of the experimental processes.

The laboratory presents an ideal environment in which to accept and meet the challenges of computational science and engineering. Issues that must be addressed include mathematical software, electronic prototyping, geometric modeling, parallel algorithms, databases, software engineering, and computer systems. This facility is use for research in electronics, computer science and engineering Department.

In order to support the various activities that take place in a physical laboratory, scientists must be able to use the virtual laboratory to

- perform physical experiments by interacting with and controlling remote instruments,

- simulate physical experiments through computer modeling of the experimental process,
- compare physical and simulated data by playing back recorded experiments, and
- Train scientists to understand the physical experiment, the computational model of the experiment, and the relationships between them.

A choice of these four *scenarios* is available to scientists after they have selected their virtual laboratory at the SoftLab gateway. The graphical interface which is then presented to the user is a software representation of the physical laboratory. Each important physical device is present, in particular, all instruments and equipment used during the experimental process must have a visual representation in the virtual laboratory.

In the *virtual experimentation scenario*, scientists will set up the virtual instruments and experimental process just as in the physical scenario. Afterwards, the physical setup is transformed to the input required for the computational model. Additionally, parameters that are strictly numerical will be specified via special interfaces, and an expert system will be on hand to query for process characteristics or computational parameters. During the processing of the computational code, the virtual instruments will receive intermediate results so that they can be animated to show the progression of the simulation process. Results can be visualized exactly as in the physical case. The simulated experiment may also be saved to the experiment database. Here, too, the input configuration and output results will be used to define the experiment in the database. Since the physical and simulated experiments now reside together, computations on their associated data can easily be done for comparison or analysis.

VIS can benefit thousands of students and professors to learn difficult experiments. The “Virtual laboratory” will bridge physical distance and availability of resources. Today it is possible to design good experiments among students for better learning.

VIS provides following benefits for Teachers

- Visual experiments for lectures.
- Home Experiments for students.
- Virtual laboratory exercises in lab session.
- Opportunities for independent exploration for highly motivated students.
- Animated visualization for students in classroom.

VIS provides following benefits for Students

- Experiment with electronics component safely and independently
- Supplement classroom exercises to improve understanding with electronics devices.
- Visual classroom laboratories at any place.

1.1 VIS USERS

VIS Can used by

- Colleges to perform practical using SoftLab
- Teachers will teach the student with different practical based concept.
- Research student perform their experiments with different devices.
- Students can read and perform their task in classroom.

Virtual Labs would helpful to students at the graduate level, postgraduate level as well as to research scholars. This would help them in learning basic and advanced concepts through Virtual Intelligent SoftLab (VIS) experimentation. This system provides a complete Learning Management system around the virtual Labs where the students can learn, observe and research the various tools. Video-lectures, animated demonstrations and self evaluation program available in future. This system also shares costly equipment and resources with visual effects. The functionality provided by this problem solving environment will therefore be:

- Collect the experimental data in real time.
- Provide visualization of the experiments.
- Control the experiment.
- Input the experimental data to the computational model.
- Control the computational model and visualize the numerical simulation solution

SoftLab is such a flexible laboratory environment. Its goal is to simulate a laboratory space having a well-equipped storeroom of instruments and a variety of materials. Using SoftLab a student may be guided by an instructor to perform an experiment, or the student might also conceive of one on his own. The student may choose a substance to study, take out the instruments he needs, connect them together, make his measurements, and record and plot his results. The computer screen is the laboratory room. The experimental possibilities open to the student certainly are limited by the ability of the developers to maximize flexibility in a practicable way. Algorithms implemented so far have achieved the desired flexibility, and SoftLab has been well received.

The SoftLab philosophy challenges us to link the physical laboratory experiment with its theoretical

simulation model within a unified and interactive environment. The goal for each instance of a SoftLab laboratory is to create a software environment where experimental research, simulation and education coexist and interact with each other in a seamless manner

Once this problem has been solved for a particular scientific environment, the design of the virtual laboratory can begin. In order to support the various activities that take place in an physical laboratory, scientists must be able to use the virtual laboratory to

- perform physical experiments by interacting with and controlling remote instruments,
- simulate physical experiments through computer modeling of the experimental process,

2. CLIPPER

Clipping circuits are used to remove the part of a signal that is above or below some defined reference level. Clipping circuits are also known as limiters, amplitude selectors, or slicers. To clip to a reference level other than zero, a dc source is put in series with the diode. Depending on the direction of the diode and the polarity of the battery, the circuit will either clip the input waveform above or below the reference level. This paper explains the working of different diode clipper circuits like Positive and Negative diode clippers using combinational clipper Circuit with the help of circuit diagrams and waveforms. The basic components required for a clipping circuit are an ideal diode and a resistor. In order to fix the clipping level to the desired amount, a dc battery must also be included. When the diode is forward biased, it acts as a closed switch, and when it is reverse biased, it acts as an open switch. Different levels of clipping can be obtained by varying the amount of voltage of the battery and also interchanging the positions of the diode and resistor. Depending on the features of the diode, the positive or negative region of the input signal is "clipped" off and accordingly the diode clippers may be positive or negative clippers. There are two general categories of clippers: series and parallel (or shunt). The series configuration is defined as one where diode is in series with the load, while the shunt clipper has the diode in a branch parallel to the load.

Positive Diode Clipper

In a positive clipper, the positive half cycles of the input voltage will be removed. The circuit arrangements for a positive clipper are generated with VIS model. During the positive half cycle of the

input waveform, the diode is reverse biased, which maintains the output voltage at 0 Volts. Thus causes the positive half cycle to be clipped off. During the negative half cycle of the input, the diode is forward biased and so the negative half cycle appears across the output.

Negative Diode Clipper

The negative clipping circuit is almost same as the positive clipping circuit, with only one difference. If the diode is reconnected with reversed polarity, the circuits will become for a negative series clipper and negative shunt clipper respectively. The negative series and negative shunt clippers are generated in VIS model.

Combination Clipper

When a portion of both positive and negative of each half cycle of the input voltage is to be clipped (or removed), combination clipper is employed. The circuit for such a clipper is given in the figure below.

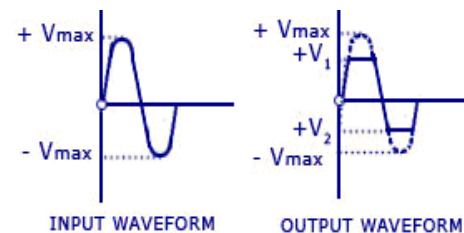


Fig-1: Input and Output Waveforms

3. TOOLS & TECHNOLOGY

Visual Basic is a third generation event-driven programming language and integrated development environment from Microsoft for its COM programming model. VB is also considered as relatively easy to learn and use programming language, because of its graphical features. Visual Basic was derived from BASIC and enables use of graphics user interface, access to database and creation of ActiveX controls and objects. A programmer can put together the component provided with Visual Basic itself to develop an application. The language not only allows programmers to create simple GUI applications, but can also develop complex applications. Programming in VB is a combination of visually arranging Component or control on a form, specifying attributes and actions of those components. Visual Basic can create executables (EXE files), ActiveX control or DLL files, but is

primarily used to develop Windows applications. The beauty of this model is that it does not require the Database to manage data [5].

4. VIS MODEL

We have constructed the programs in 'VB' such that all the blocks in the model can be fully visualized on the screen. This model can demonstrate the activities of Clippers visually. Inputs accepted through software and virtual output will observe on screen. In an experiment we can provide different input values and observe output. This model provides circuit connection facility to user to make connection properly otherwise the result not generated.

4.1 DESIGN SPECIFICATIONS

You need to design Clipping circuit that accepts input waveform and outputs are the clipped waveform. Depending on the direction of the diode and the polarity of the battery, the circuit will either clip the input waveform above or below the reference level. Virtual Instruments required as Function Generator, CRO, DC Power Supply, Breadboard, Diodes, Capacitors & resistor. For developing the concepts of Clipping based on simulation technique is shown in figure in fig-2, fig-3, fig-4 and fig-5 shown below.

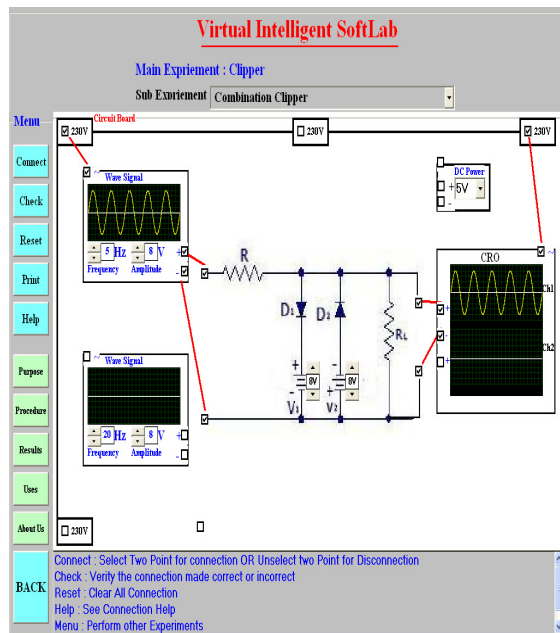


Fig-2: VIS Model with No Clipping

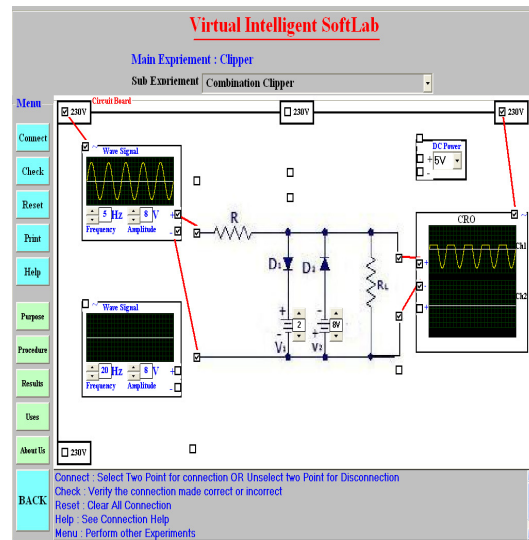


Fig-3: VIS Model with Positive Clipping

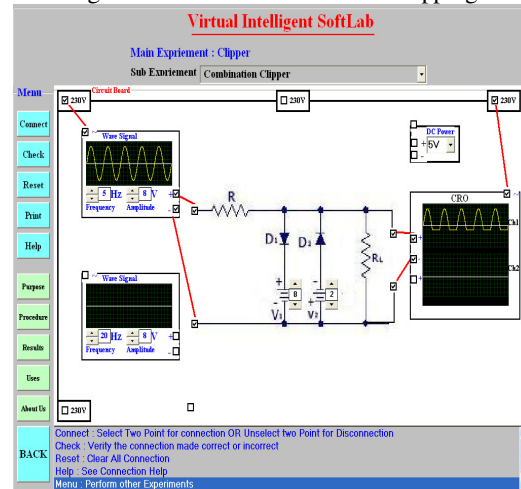


Fig-4: VIS Model with Negative Clipping

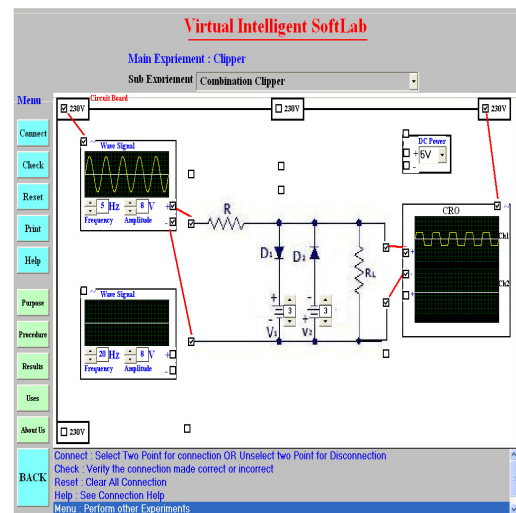


Fig-5: VIS Model with Combination Clipping

4.2 IMPLEMENTATIONS

Once the VIS is ready then we implement the circuits using then following steps. The Circuit Connection Steps are

- Connect AC power supply to wave generator virtual device and CRO.
- Connect AC wave signal to Input circuit switches.
- Connect Output pin to CRO switches

Experiment Implementation Steps are

- Made connection to selection two switches using mouse
- Click on Check Button to verify the connection
- Click on Reset Button if the connection is totally WRONG
- Click on Help Button if you need Connection HELP
- Click on Menu Button if you want to perform other Experiments

4.3 RESULTS

Virtual outputs are totally animated with the combination of software and observed actual outputs virtually. Inputs and Outputs are fully animated with virtual CRO and observed actual results.

5. CONCLUSIONS

SoftLab will help Electronics, Computer Science and Engineering department students to perform and practice experiments to improve their understanding of the subject. VIS is designed in such a way that it's made more effective and realistic by providing virtual inputs and product virtual outputs. For the 'touch and feel' part, the students can possibly visit an actual laboratory.

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Authors Profile



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