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A Labview Based Simulation of Lissajous Pattern Using DAQ Card

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Abstract

LabVIEW is a graphical programming language. LabVIEW provides the flexibility of integration of data acquisition software/hardware with the process control application software for automated test and measurement applications. In this paper, an effort is made to obtain a lissjous pattern using DAQ card and measure the phase difference between two signals acquire by DAQ.
Also we try to replace the DSO by a LABVIEW software. All the values which are obtained by CRO or DSO can be easily obtained by this effort.

Keywords: LABVIEW, DAQ, Lissajous Pattern, DSO, Phase Difference, Function generator.

1. Introduction

Virtual instrument is a computer instrument system. The system is based on the computer including a lot of hardware equipment and the consumer design the virtual panel and procedure to achieve the testing and controlling aim. In recent years, virtual instrument technology has been applied extensively in various fields, such as industrial control, communication, automation electric power and electronic and industrial production.

Virtual instrumentation software is user defined and focused on the needs of the application. For instance, researchers can build custom virtual instruments that can apply real-time mathematics for processing, analysis, and control involving online (live) and/or offline (from a file / database) signal I/O. Using the virtual instrumentation approach, applied mathematics is combined with real-time measurements, which helps researchers reduce the time to discovery and, potentially, the time to market and/or time to commercialization of potential products and services that result from research and development (R&D).

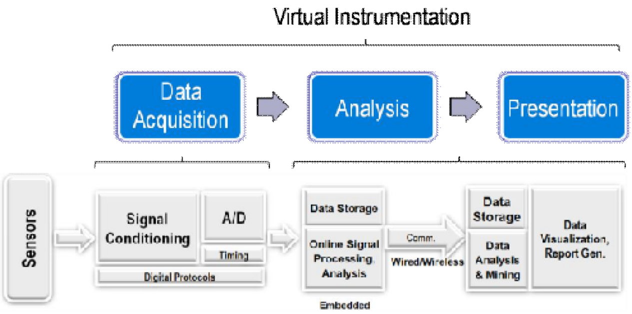

Fig. 1: Block Diagram of Virtual Instrumentation.

A digital storage oscilloscope is an oscilloscope which stores and analyses the signal digitally rather than using analogue techniques. It is now the most common type of oscilloscope in use because of the advanced trigger, storage, display and measurement features which it typically provides. Digital storage oscilloscopes have the advantage of capturing and logging electronic events that may have occurred when no one was present, or when observation was otherwise impossible.

2. Circuit Detail

If two phase-shifted sinusoid inputs are applied to the oscilloscope or DSO in X-Y mode the phase relationship between the signals is presented as a Lissajous figure.

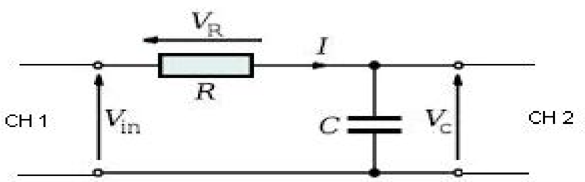

Fig. 2: Circuit Diagram of a System.

But if we apply these input and output channels to DAQ then the lissajous pattern can be seen in LABVIEW.

3. Block Diagram of the System

This Block Diagram shows the combination of software and hardware. We apply input signal to the circuit through function generator and also seen this into LabVIEW through DAQ Asstt. 1. Now check the output signal after phase shift in LabVIEW using DAQ Asstt. 2. At last it can be graphically represented in XY graph.

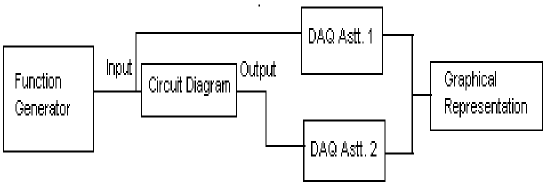

Fig. 3: Block Diagram of System.

4. Simulation Results

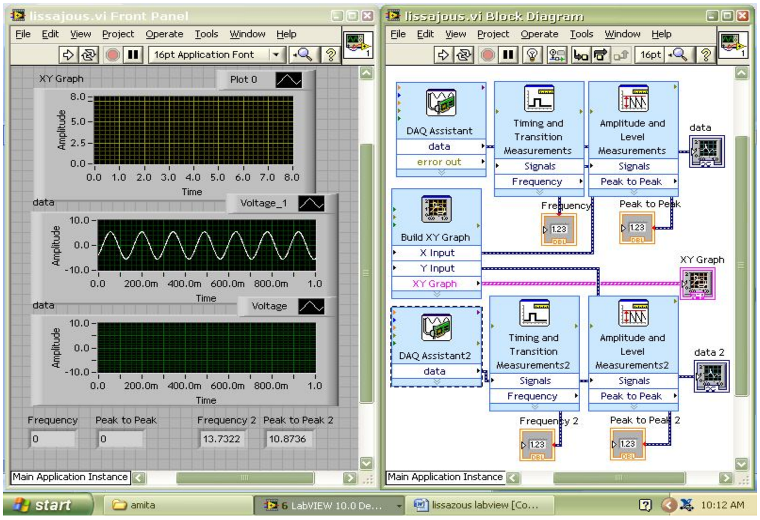

Fig. 4: Waveform obtained by channel 1 only

This observation shows that DAQ acqire only channel1 . Now we try to run again to simulate another channel also.

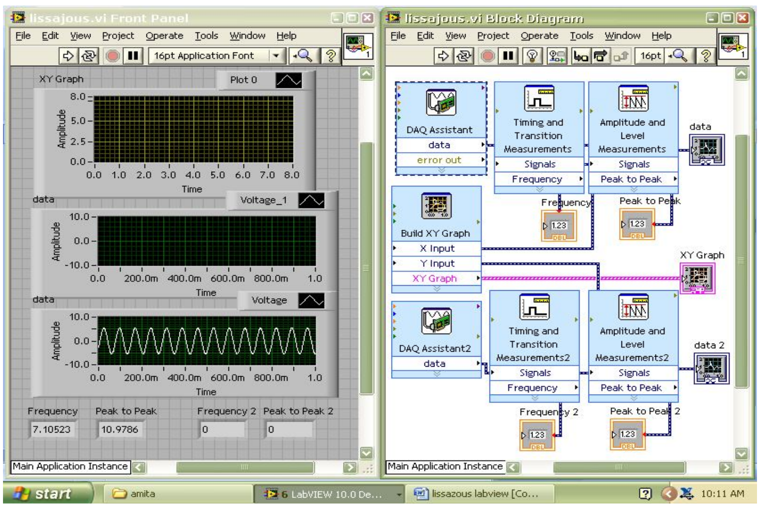

Fig. 5: Waveform obtained by channel 2 only.

The observation shows that this time DAQ acquire Channel 2 only. So we try to do this by LabVIEW also.

For this we simulate two function generator in LabVIEW and then from that function generator we can apply the signals into XY graph. Now the result we obtained is shown below

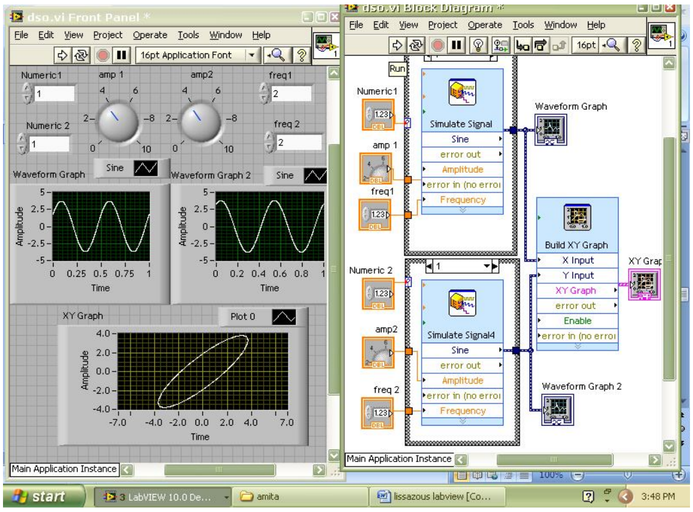

Fig. 6: Lissajous Pattern Obtain in LABVIEW with same frequency.

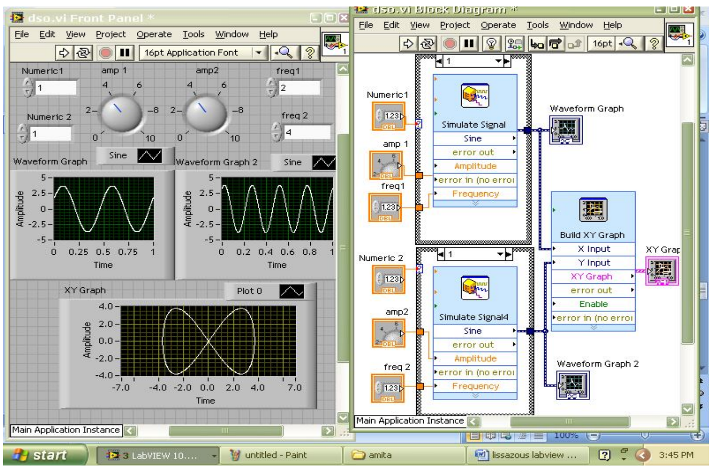

Fig. 6: Lissajous Pattern Obtain in LABVIEW having frequency ratio 2:1

These results shows that the circuit is working properly in LABVIEW but the only problem is that the DAQ is sensing only one channel at a time. We have to do work on multitasking to overcome this problem.

Lissajous curves can also be generated using an oscilloscope. An octopus circuit can be used to demonstrate the waveform images on an oscilloscope. Two phase-shifted sinusoid inputs are applied to the oscilloscope in X-Y mode and the phase relationship between the signals is presented as a Lissajous figure.

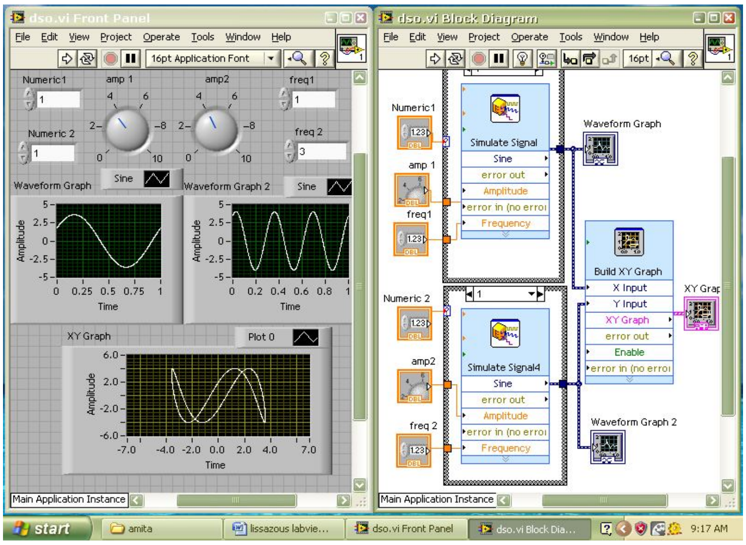

Fig. 6: Lissajous Pattern Obtain in LABVIEW having frequency ratio 3:1

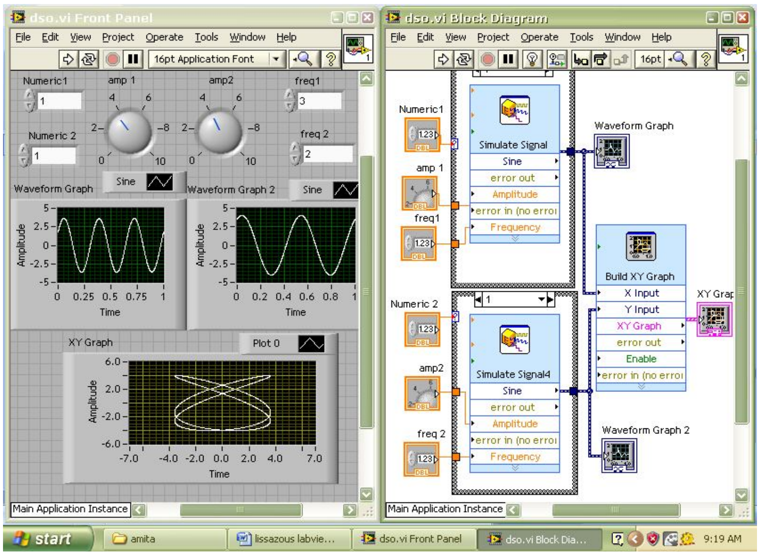

Fig. 6: Lissajous Pattern Obtain in LABVIEW having frequency ratio 3:2.

On an oscilloscope, we suppose x is CH1 and y is CH2, A is amplitude of CH1 and B is amplitude of CH2, a is frequency of CH1 and b is frequency of CH2, so a/b is a ratio of frequency of two channels, finally, δ is the phase shift of CH1.

5. Drawback

Unable to acquire multi channel in DAQ. If we are doing so it can only acquire one channel at a time.

6. LABVIEW Applications

Although a main focus of this special issue is about engineering education with LabVIEW, the major developments in LabVIEW programming cover a wide range of engineering solutions varying from space technology to the nuclear power area. Furthermore, due to the modular structure of the software, any of these engineering applications may be integrated to the engineering courses. The market and the user responses indicate that LabVIEW is one of the primary choices in designing control and analysis solutions in the area of engineering technology and education. Some of the exceptional LabVIEW user solutions listed below are reported, as `user solutions' by the National Instruments Corp. [7], which all are multidisciplinary engineering solutions:

- Maintaining emission standards in automotive industry;
- Remotely operating motion control applications and teaching automatic control techniques;
- Making waves in laboratory and process control;
- Radio linked environmental monitoring and display system;
- Engaging in pre-flight satellite manoeuvres;
- Monitoring isolated well-drilling pumps across the Internet and over satellite up-links;
- Identifying manufacturing defects, nabbing defects in robotic welding;
- Image recognition;
- Monitoring power plants over the Internet;
- Calculating gas containment;
- Testing and producing performance characteristics of motors;
- Tracking weapon explosions;
- Real-time dynamometer control;
- Control system for experimental supercritical water;
- Thermal mapping of integrated circuits;
- Automating seedling analysis;
- Nuclear power plant monitoring [4].

In the paragraphs below, a survey result of LabVIEW-based virtual instrumentation applications that are implemented in engineering education are given. However, due to the large number of applications, the classification is done based upon the engineering disciplines identified. It should be noted that many of the applications reported here, are predominantly interdisciplinary applications.

References [1] and [4] contain two major collections of LabVIEW software applications in general engineering, and due to the large number of papers reported in these references, the papers in the proceedings are not summarized separately below. The reference [1] contains 33 papers and covers: mechanical engineering, electrical and nuclear engineering, physics, biomedical engineering, chemistry and chemical engineering, and data acquisition and instrument control over the Internet. The second reference [4] also covers similar topics and includes 30 technical papers.

7. Future Trends In Engineering Education

Print materials are increasingly being distributed in electronic format (either online or CD-ROM). It is expected that this will greatly change the nature of the information or how it is used. Therefore, a major emphasis in the future will be to access instructional and laboratory components via the Internet. The Intranet link at the university campus may also be used to bring the real-time Towards Virtual Laboratories: a Survey of LabVIEW-based Teaching 7 laboratory data into the classroom teaching to support the theory.

Furthermore, when technology-intensive teaching tools become widely available, the traditional roles of the university lecturers will change from pure classroom-based teaching to one of consultation, advice and direction giving. However, it is believed that the technology-based course will not eliminate the educators; instead it will change the type of activities the educators carry out. In the technology-based teaching/learning practice, the major activities of the lecturers may include preparation of the software packages, adopting new concepts and new teaching practices, modifying existing materials to suit the changes introduced in the latest version of the multimedia tools, and above all these they can spend time to continuously evaluating the teaching/learning outcomes. As is reported in the literature, including the Internet resources, remote experimentation is not limited to education. In research and industry, remote access also represents an opportunity for the scientists and engineers who wish to share unique and expensive equipment. Therefore, it is expected that the collaborations between the higher education institutions and industrial organizations will increase and hence will provide opportunities to share the expensive and the complex experimental setups, training and teaching materials across the organizations. The robotics laboratory reported in [5] is a very good example of `sharing laboratory facilities' for teaching purpose, which reduced the cost while increasing the knowledge distribution. It is also expected that `remote experimentation' will reduce the number of identical experimental setups used in the conventional laboratory practice. The distinction between the traditional laboratory class and the remote area experimenting via Internet may become absolute in many engineering disciplines. Therefore, the Internet and/or Intranet links may bring the hazardous and dangerous laboratory [36] into the classroom or learning environment. In the case of harsh and dangerous environment laboratories the users can access the complex, large or expensive plants remotely, and experience first hand system behaviour via the Internet that is not possible or practical in the traditional laboratory practices. However, some legal issues must be solved before sharing sensitive information between the institutions, which can easily be solved by granting a limited access to the external users. The technology may also be used to provide hands-on industrial training facilities remotely for the engineering students. The potential employers of engineering graduates may provide a real training environment to prospective employees (UG or PG students) at the university level.

Finally, as in the `Open University' practice, the on-line learning is more convenient and immediate for many people. Although this practice is not widely accepted in experimental work in engineering, the computer technology may be utilized to store the real-time test results and the real experiment can be imitated later for other users.

8. Conclusions

1. Lissajous pattern can be easily generated by making two function generator in LabVIEW and then from both function generator apply signal to X channel and Y channel respectively. But if we are try to do this with the help of DAQ then we face the problem of acquiring multi channel. As there is a provision of selecting multichannel but by that also DAQ sense one channel at a time.
2. The roles of teachers and students are changing, and there are undoubtedly ways of learning not yet discovered. However, the computer and software technology may provide a significant role to identify the problems, to present solutions and life-long learning. It is clear that the computerbased educational technology has reached the point where many major improvements can be made, and significant cost reductions can be achieved, specifically in the area of engineering education. In engineering, the full-course (lecture . laboratory component) may replace the existing lecture-based courses, and the virtual instruments may provide a highly interactive user interface and advanced analysis facilities that were not deliverable in the conventional methods.

From the educational point of view, it is expected that the new teaching/learning technology tools available in the market may provide common experiences to cater for students who are coming from increasingly diverse backgrounds, and whose learning is best achieved in a contextual setting. However, more designing, teaching and organisational skills are now required to establish a good course material utilising computer interaction and multimedia capabilities in engineering disciplines. Therefore, the selection criteria of a suitable software is the major issue, which should have a long life-cycle, easy interface with the hardware products, and be compatible with the existing development tools. However, it should be emphasised here that having proper equipment and technique will not ensure a problem-free system. The proper use of techniques, and methodologies are also critical in any technology intensive teaching/learning development system.

In addition, it should be ensured that the designed work keeps up with the curriculum review and update, and the laboratory work should be relevant to the material taught in lectures. These may require continuous update of the material, which may change the role of the educator. Furthermore, the Internet has the potential to provide a highly supporting learning environment. It can enable students to access without any time and distance limitations, and can allow them to use expensive laboratory experiments to which they usually have no access. However, it is not sufficient to expect that existing tools and techniques will translate simply and quickly. They have to be transformed in ways that learners and educators perceive to be useful and effective. The user friendly GUI may provide a better scientific picture of the system under test. Moreover, using distance learning may attract new students and 8 N.

Ertugrul add value to education. Equipping the laboratories with effective education tools can empower both the disciplines and the students. Hence, the effectiveness of the laboratory course in imparting knowledge increases and it enables the students to absorb the role of individual engineering disciplines and addresses the real problems. It is clear that change is necessary because many of the things that we are doing can be done better with the help of technology. Although the initial cost may be high, if the right technology is selected continuous improvement can be achieved with minimal cost. The cost of the development may be reduced further if the portion of the existing hardware is utilised and integrated with the existing system. If the size and the complexity of the system increase, organisations and universities may undertake laboratory developments in partnership with other universities and/or commercial partners.

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