

AC 2008-1942: TEACHING ELECTRIC CIRCUITS USING TABLET PC AND CENTRA

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Teaching Electric Circuits Using Tablet PC and Centra

Abstract - An increasing trend for lecture-based courses is for instructors to convert their lecture notes to PowerPoint based presentation. While there are many advantages to electronic projection, a large drawback is the loss of interactivity. The use of a Tablet PC by the instructor promises to overcome this difficulty. The Tablet PC, combined with appropriate software, enables the instructor to “write and draw” using digital ink. This work describes our experience in using Tablet PC in conjunction with Centra to teach Electric Circuits. A typical lecture consists of preparing the agenda and lecture notes using PowerPoint. The PowerPoint presentation includes explanations of the covered topics and only statements of the problems that are going to be discussed during the lecture. When an example is reached, the Journal Viewer of the Tablet PC would be used to show step-by-step solution of the problem. The Journal Viewer file will include the schematics of the example problem. Electronics Workbench is used for schematic drawings. A brief discussion of this approach and the advantages and disadvantages of such a scheme will be presented.

Introduction

Electronic projection usually in the form of PowerPoint slides that are shown to students while the instructor discusses the material on the slides is an increasingly common method for instructors to present lecture material. However, this approach can potentially lead to ineffective classroom teaching¹⁻³. There are also works that have focused on making their PowerPoint presentations more effective⁴.

Teaching with Tablet PCs has recently attracted attention as a potential tool for educational use and a “Classroom Presenter” system has been developed⁵⁻⁷ for delivering computer science courses. Surveys of this system⁵⁻⁷ indicate that students pay more attention and gain a better understanding of the course material. The system described in [5] was further extended for collaboration and active learning within the classroom, where students could submit digital ink-based material to the lecturer, within a Tablet PC-based classroom, to display on the projector⁸. Based on our experience, the Tablet PC provides a different form of interactive electronic whiteboard teaching in a classroom environment. Compared to a laptop, a Tablet PC offers several advantages, including the ability to 1) prepare lectures using PowerPoint slides and annotate these during the lecture; 2) maintain constant eye contact with the class since there is no need for the lecturer to turn to the board; 3) revisit previously discussed material during the class; 4) switch easily to other applications such as a National Instruments’ Multisim⁹ or MATLAB¹⁰ and use the digital pen to draw attention to a specific item; 5) avoid labor-intensive PowerPoint animations in lecture notes as the Tablet PC allows annotation with natural handwriting; and 6) Tablet PCs can also increase collaboration and communication in small group exercises. Students can work together on an involved work-out problem, communicating visually. Moreover, by using the Tablet PCs and wireless networking, the students participating in the group will not need time to move about the room, instead switching to another application window on the Tablet PC is all that is required. In this work we present a way to use Table PC’s unique features for presenting lectures and use Centra¹¹ system, a real-time communication,

collaboration and learning over-the-Web software, to make the lectures more interactive and record them for future access by the students. Centra system was chosen due to students' familiarity with the system and the ability to download the recordings as an executable file.

Implementation Plan

This section describes, in detail, our implementation plan including the hardware-software. The idea behind using Tablet PC and Centra system came after our successful experience in flexible delivery system using Centra.

Hardware-Software requirements

The software and hardware requirements includes: Centra, Multisim, MATLAB, one Tablet PC for the instructor and one for each team, consisting of 2-3 students, and Internet-camera for the instructor. Wireless Internet connection is also an important issue as it should be capable of handling the required bandwidth.

Teaching Process

A typical lecture consists of preparing the agenda and lecture notes using PowerPoint and uploading them to the Centra system. The PowerPoint presentation includes explanations of the covered topics and statements of the problems that are going to be discussed during the lecture, Figures 1-2. Students (or teams) are expected to login to the Centra system before the lecture starts, using the provided Tablet PCs. An ideal situation is to have one Tablet per student. During the lecture, when an example is reached, the Journal Viewer of the Tablet PC would be used to show step-by-step solution of the problem, Figure 3. The Journal Viewer file will only include the schematics of the example problem. Multisim is used for schematic drawings and simulations. The lecture also includes a number of in-class exercises that student teams are expected to work out together. Subsequently, a team would be randomly selected and its worked out solution will be presented to the whole class via Centra. A short discussion will follow and in case there are alternative solutions from other teams, they would be presented. All these steps would be recorded by Centra and students can download the entire lecture and watch it later, Figure 4. We believe that this methodology is useful, but not as effective, even if there are no Tablet PCs available for students. The usefulness of such an approach is that students have access to a supplementary resource, with auditory and visual explanations, which can be used outside of class. The "live-action" worked-out problems can help students to improve their problem-solving skills.

Delivery Experience

Spring 2007

The aforementioned delivery system was used starting the second week of the semester. Students taking the electric circuits course had prior experience with Centra and had no difficulty adjusting to the new lecture format. On the other hand they had no experience using Tablet PC and it took some time for them to become comfortable with the Tablet, Journal Viewer and digital ink. Our focus during this trial experience was on lecture preparation and the delivery

system. No formal student learning evaluation was carried out. On the other hand several informal student satisfaction surveys, focusing on the delivery system were done, which convinced us that we were on the right track.

Spring 2008

We are using the same approach again this semester and planning to start a formal student learning evaluation. For the time being we consider the proposed approach as a way to increase student participations in lectures and a means to download the recorded lectures.

Student and Course Assessments

The assessment of student learning objectives is crucial in this work. Thus, the evaluation of students is both formative and summative. The following integrated, but separately assessable components will be used in the assessment process:

- Class participation
- Homework assignments and Exams
- Comparison of the students' grades with previous semesters

During the spring 2008 semester we are planning to conduct two online evaluations, focusing on the effectiveness of the delivery system and the usefulness of the Tablet PC and in-class group problem solving.

Conclusion

It is our belief, and many others that teaching and learning must move towards more innovative and inclusive ways and that active participation should replace passive learning. Such a vision, although not altogether novel, recognizes contemporary educational themes that include open and flexible learning, and widening participation. In this context, we believe that the proposed methodology can play a significant role. It can help to change passive delivery to a more active and flexible delivery methodology. The proposed approach is also an ideal tool for problem based learning methodology.

References

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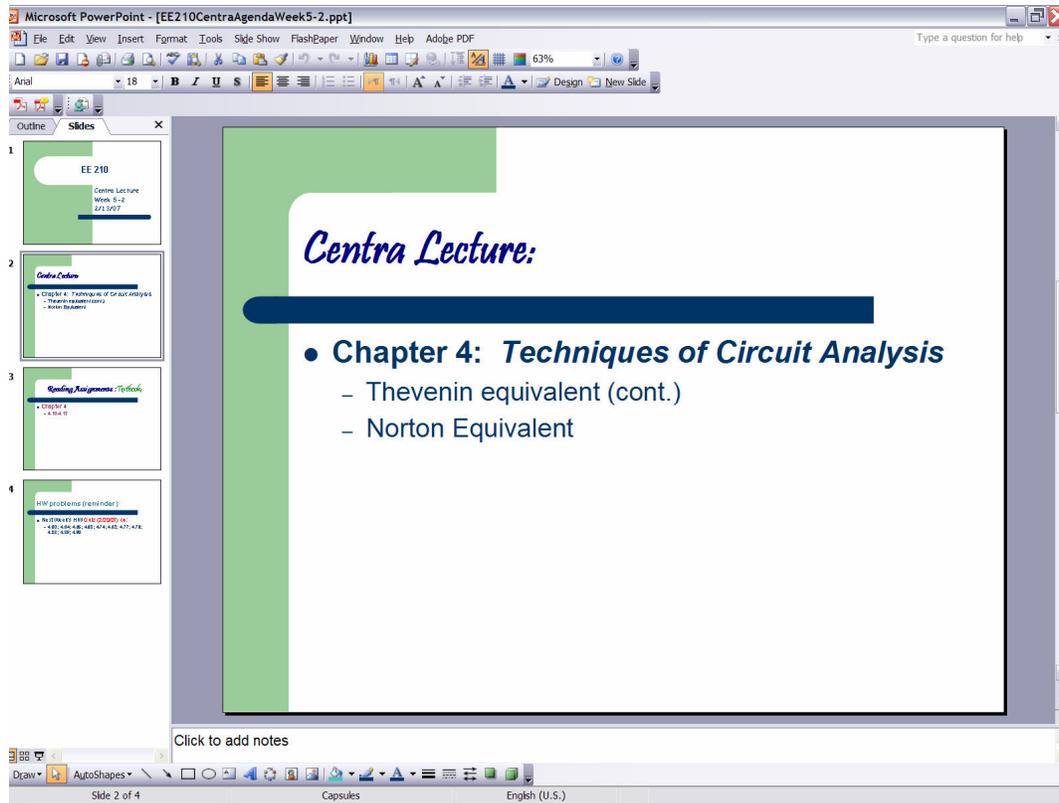


Figure 1. Sample of a daily agenda

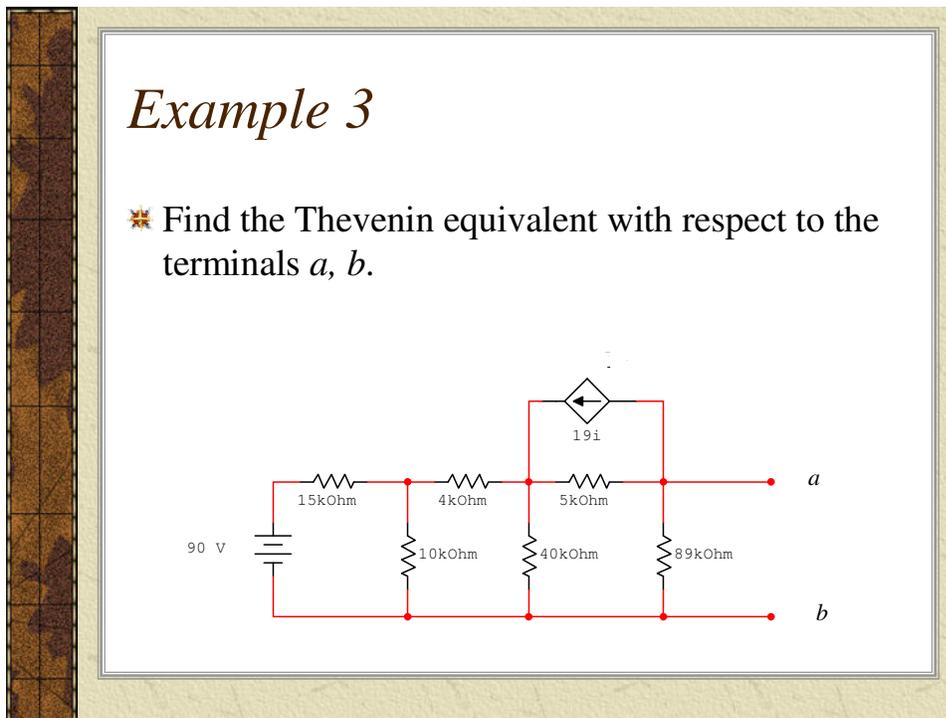
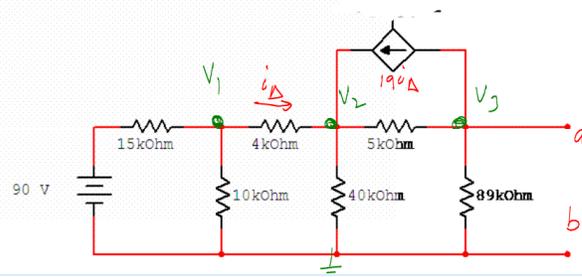


Figure 2. Sample lecture page

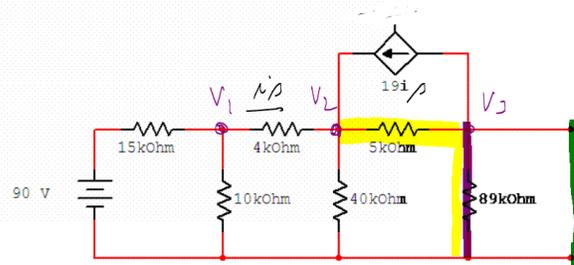
Example 3 (P 4.68, pg 172)



$$\begin{aligned} \frac{90 - V_1}{15K} - \frac{V_1 - V_2}{4K} - \frac{V_1}{10K} &= 0 & -19i_{\Delta} + \frac{V_2 - V_3}{5K} - \frac{V_3}{89K} &= 0 \\ \frac{V_1 - V_2}{4K} - \frac{V_2}{40K} - \frac{V_2 - V_3}{5K} + 19i_{\Delta} &= 0 & i_{\Delta} &= \frac{V_1 - V_2}{4K} \end{aligned}$$

$$V_1 = 32.75, V_2 = 30.58, V_3 = -19.8V$$

$$V_{oc} = V_3 = -19.8V$$



$$i_{sc} = \frac{V_1 - V_2}{4K}$$

$$\frac{90 - V_1}{15K} - \frac{V_1}{10K} - \frac{V_1 - V_2}{4K} = 0 ; \frac{V_1 - V_2}{4K} + 19i_{sc} - \frac{V_2}{5K} - \frac{V_2}{89K} = 0$$

Figure 3. Sample worked example

Centra 7 - EE 210 (LMN373490)

View Help

AppShare 00:02:26 / 00:16:09

EE 210-W5-2 - Windows Journal

Appshare Tools

Participants: JoJo, Yatrik

$$90 - V_1 - \frac{V_1 - V_2}{4K} - \frac{V_1}{10K} = 0$$

$$\frac{V_1 - V_2}{4K} - \frac{V_2}{40} - \frac{V_2 - V_3}{5} + 190 = 0$$

Agenda

- EE210CentraAgendaWe...
- EE 210
- Centra Lecture:
- Reading Assignment...
- HW problems (remin...
- EE210CentraLectureWe...
- EE 210
- Chapter 4: Technique...
- Thevenin (rev.)
- Norton
- Thevenin (rev)
- Finding Thevenin Eq...
- Finding Thevenin Eq...
- Example 1
- Example 2
- Example 3
- Example 4

start | Inbox ... | Welco... | 2 Wi... | Teachi... | 8 A... | 5 Mi... | Macro... | EE 21... | Centra... | 9:06 PM

Figure 4. Sample page from Centra playback recording