

## Dynamic and Resonating Use of WebCT

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### Abstract

Using web-based instructional tools to augment the traditional lecture-based delivery of course content enhances the learning experience for many students. The on-line components facilitate student education by guiding study activities outside the classroom lecture time. The extended use of a standard web-based educational environment, WebCT, in two mechanical engineering courses, sophomore-level dynamics and junior-level vibrations, is showcased.

Various features of WebCT are presented and provide examples of how engineering content can be effectively delivered with web-based tools. Advantages of using WebCT over faculty authored web-sites include password protected log-in only for enrolled students, grading database, quiz database, organization structure for course content, built-in communication tools, and archival storage of course material. In two years experience with WebCT, the authors have found that maximum results with minimum time invested are best achieved through shared effort. Now, we'd like to share our work with you.

### 1.0 Introduction

The paper describes the use of WebCT in two required mechanical engineering courses at Tennessee Technological University. The authors augment the in-class instruction of sophomore-level Dynamics and junior-level Vibrations and Simulations classes with WebCT. The paper presents the design/organization of each of these courses and provides contextual commentary on various features of WebCT.

For the reader unfamiliar with WebCT, it is an on-line course management software that is accessible by the course designer/instructor through the Internet. An on-campus server hosts the institutional version of the software. The software features in-built "tools" that can be used to produce an attractive and efficient course web site without extensive experience in HTML or web site design, making it a valuable resource for professors short on time.

After describing the courses, the authors share general observations and discussion about their experiences with the use of electronic enhancement of the traditional black/white board lecture style and standard homework techniques. Finally a brief background and timeline of the authors' development schedule for the courses is offered. Without the extensive resources available at

some institutions to support course development and management on-line, it can be daunting to wear a combination of hats, course designer, content provider, and technology guru, depending on need. However, it can be done and can be enjoyable as well.

## 1.1 WebCT Jargon

WebCT jargon is used throughout the paper. Some key terms are defined later through descriptions in the paper. However, for clarity a few terms are defined early on. An Organizer Page is a page on the site that can have subsequent links from it. A Single Page on the other hand is either HTML coded text, or could be a link to a \*.doc, \*.pdf single file, etc. WebCT Tools is the term used to indicate that an inbuilt feature of WebCT is being used. WebCT has four categories of Tools.

1. Course Content or Related Tools
2. Communication Tools
3. Evaluation Tools
4. Study Tools

## 2.0 ME2330 Dynamics

The ME2330 Dynamics course WebCT site was designed by C. Darvennes. The text for this course is Dynamics, Bedford and Fowler. The homepage has eleven links, and is pictured in Figure 1.

[ME 2330-001 - Engineering Mechanics-Dynamics - Spring 2002](#)  
[Home](#)

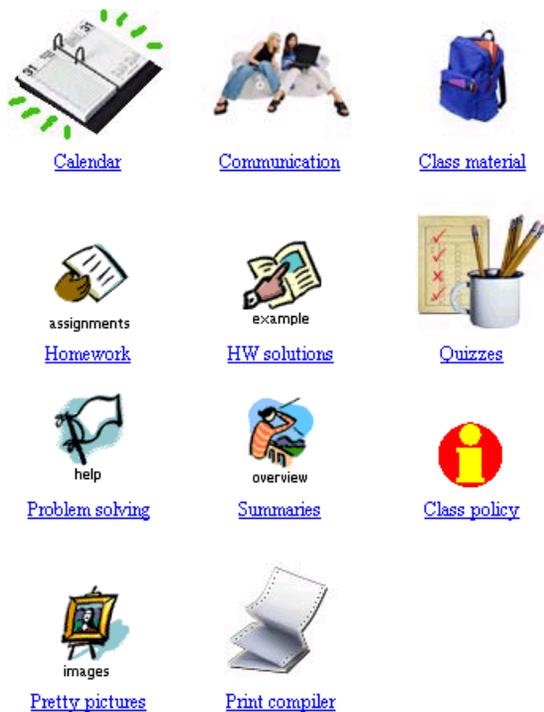


Figure 1. ME2330 Dynamics Homepage

The main links are:

1. Calendar (WebCT Tool)
2. Communication (Organizer Page)
  - a. Discussion (WebCT Tool)
  - b. Mail (WebCT Tool)
  - c. Chat (WebCT Tool)
  - d. Whiteboard (WebCT Tool)
3. Class Material (Content Module)
4. Homework Assignments (WebCT Tool)
5. Homework Solutions (Organizer Page)
6. Quizzes
7. Problem Solving (Organizer Page)
  - a. Chapter 2 Methodology,(pdf file)
  - b. Chapter 3 Methodology,(pdf file)
  - c. Energy and Momentum,(pdf file)
8. Summaries (Organizer Page)
  - a. Ch 2&3,(pdf file)
  - b. Ch 4&5,(pdf file)
  - c. Ch 6&7,(pdf file)
9. Class Policy (Organizer Page)
  - a. Policy,(pdf file)
  - b. Portfolios,(pdf file)
  - c. Study Rules,(pdf file)
  - d. ABET criteria,(pdf file)
10. Pretty Pictures
11. Print Compiler(WebCT Tool)

### 3.0 ME3050 Mechanical Vibrations and Simulations

The ME3050 Vibrations WebCT site is shown in Figure 2. The text for the course is Vibrations, 2e, Inman. The Vibrations homepage page has eight links.

**ME 3050 - 001 - Mechanical Vibrations and Simulation - Spring 2002**

[Home](#)

# ME 3050 VIBRATIONS



Figure 2. ME3050 WebCT homepage

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1. ME3050 Policy (An Organizer page)
  - a. Pardue Syllabus
  - b. Portfolio Policy
  - c. Tell Me Again
2. Calendar (WebCT Tool)
3. Communication(Organizer Page)
  - a. Discussions
  - b. WhitBoard
  - c. Chat
  - d. Student Homepages
  - e. Mail
  - f. Compile Content Modules
  - g. Check My Progress
  - h. My Grades
4. ME3050 Contents(Organizer Page)
  - a. Module 1 (Content Module)
  - b. Module2 (Content Module)
  - c. Module3 (Content Module)
  - d. Module4 (Content Module)
  - e. Module5 (Content Module)
5. Homework Assignment (WebCT Tool)
6. Quiz (WebCT Tool)
7. Solutions (Organizer Page)
8. Resources (Organizer Page)
  - a. Summaries, helpful hints (pdfs)
  - b. URLs to other sites
  - c. MATLAB files (Organizer Page)
    - i. \*.m files

#### 4.0 Calendar

The Calendar is a “tool” that is written into WebCT. The instructor has the freedom to add tools to the site as needed. Links to outside URLs as well as internal links to Content Module pages are easily added to the calendar in addition to other text- type daily reminders. A monthly view, see Figure 3, or weekly view of the calendar is available. The students can compile calendar entries at any time. In fact, a global calendar can be made available for the students, which allows for a conglomerate report of all WebCT enabled course entries. Immediately after a student logs into WebCT, a highlight list of what is recently added or what activities are imminent for the class is shown, see Figure 4.

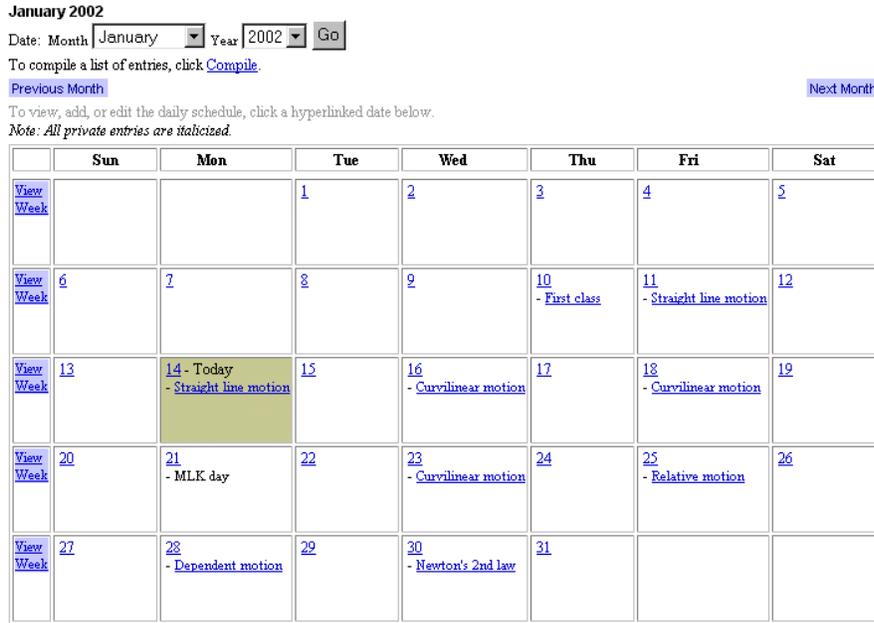


Figure 3. Typical Monthly Calendar

**ME 2330-001 - Engineering Mechanics-Dynamics - Spring 2002**

Instructor: Corinne Darvennes

- [There are 2 quizzes available now \(2 new\)](#)
- [There are 3 assignments available now](#)
- [There are new discussion postings](#)
- [The assignment HW2.2 is due in 1 day \(1/16/2002\)](#)
- [The assignment HW3 is due in 3 days \(1/18/2002\)](#)

Figure 4. Student View of Initial Page after login to WebCT

**5.0 Communication**

Various communication tools such as synchronous (live) chat, and asynchronous (time-delayed) email and discussion boards provide forums for faculty-student exchange extending the traditional office hours into virtual space. The Communication tools in WebCT are Discussions, Mail, Chat, and Whiteboard. Other tools that WebCT classifies as Evaluation Tools, like My Grades, can also be included in the Communication category. Another example, WebCT has a tool to allow students to post their own information within the WebCT site, called Student Homepages. While WebCT calls this a Study tool, Pardue placed it in the communication area.

**5.1 Chat**

The synchronous tool, Chat consists of four possible meeting rooms where conversations are recorded or open meeting rooms where no recording takes place. The Chat window shows the user who else is logged into that room. In Fall 2001, Pardue used the Chat tool to provide virtual office hours and on-line help sessions twice a week, on Tuesdays and Thursdays from 9-10:30pm. A typical excerpt of logged chat is shown below.

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Nathan Rinderer>>i was having difficulty with number 4 as well  
 Emery Ward>>let me see if i can ask this with any simplicity, if not, i can just ask in person some time  
 Sally Pardue>>nick did you erase the sketch on the whiteboard?  
 Emery Ward>>for the disk of prob 4, i get the  $(k_1+k_2)$  term to be positive Lagrange method and negative for newton method  
 Emery Ward>>andrew did  
 Emery Ward>>i can draw again  
 Lucas Yeary>>I have a question on prob. 2. Do the springs take into account the potential method of the bar or do I find it by itself.  
 Emery Ward>>but if the assumption forces for  $k_2$  spring are drawn in a different manner, i get the positive  $(k_1+k_2)$   
 Sally Pardue>>lucas, i am unclear of you question.  
 Emery Ward>>don't worry about mine, i will just ask you in person sometime  
 Lucas Yeary>>Does the bar have any potential ENERGY (sorry) that we have to take into account.  
 Emery Ward>>it will be much easier that way....thank you for the "moment of inertia" question.  
 Nathan Rinderer>>On numbers 1 and 2 I'm ending up with multiple terms involving theta for my equations of motion, do I combine the terms and then calculate the natural frequency  
 Sally Pardue>>on p2 since the bar's weight is supported by the springs, there is no need to consider the change in potential energy due to the CG moving  
 Lucas Yeary>>thanks, thats how I worked it

Early usage (first five weeks) of these on-line help sessions was high and the students were willing to keep trying, although maintaining two or more simultaneous question/answer series becomes difficult. Average number of students participating through the session time was ten, approximately  $\frac{1}{4}$  the total course enrollment. Some students who participated regularly in Chat were the ones who also visited during regular office hours. Other students only sought help through the on-line office hours. Pardue also found there were students who were happy watching the Chat room, not actively participating. Perhaps intimidated by the interface, they were at least willing to observe.

## 5.2 Whiteboard

The Whiteboard is a synchronous communication tool. A sample screen from a help session held on-line by Pardue is shown in Figure 5. The users who are logged into the Whiteboard are shown to the right. The tool has simple drawing shapes and text features. This enables drawing FBDs, but doesn't help for rapid equation posting. The user either relies on mouse drawing of text, or uses the text tool more slowly and with programming language syntax. An electronic pen and pad would provide a neater interface than a mouse. As a professor, one could justify the expense for home-use, but would it be fair to ask all students to have one?

A disconcerting feature of the Whiteboard is that it is open for the other users to erase what just took 5 minutes to draw. The virtual space of the board expands as you write into new regions. One can easily get lost left to right and up and down; the screen updating with location scrollbars was sluggish even at cable modem speeds. Students logged in remotely from home using standard modem bandwidth indicated they could not have both Chat and Whiteboard open simultaneously; even with cable modems both tools open for long periods encouraged browser lock-up.

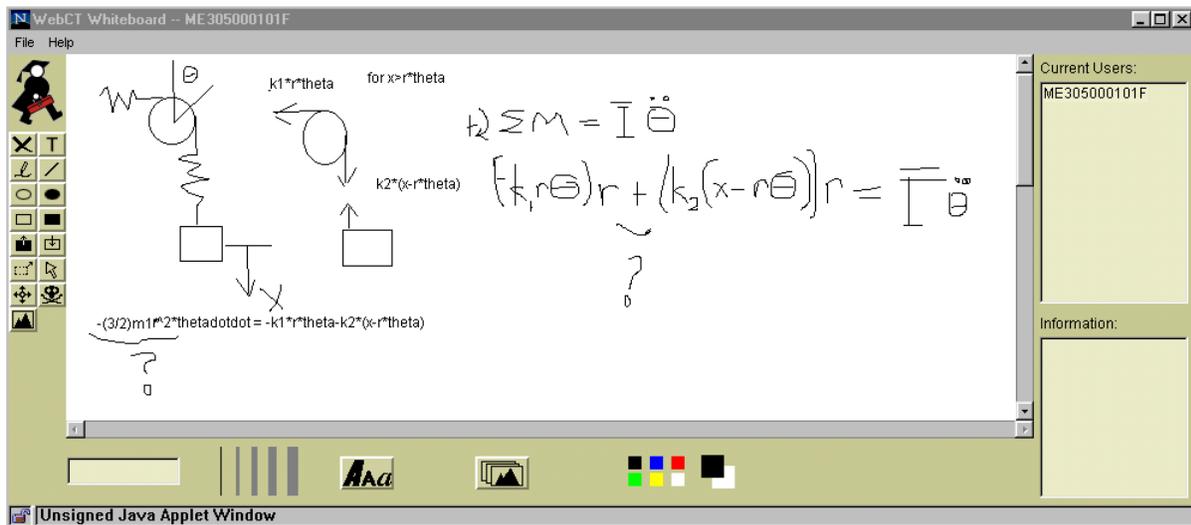


Figure 5. A typical Whitboard session in Vibrations

### 5.3 Discussion

The Discussion tool is asynchronous, like a standard discussion board. Students, instructors, TAs can post statements. The instructor can set up various discussion listings that students can select to post to. Threaded replies are possible. There was some usage of this feature to provide hints or clarifying comments on Homework Assignments or Solutions.

### 5.4 Mail

The mail tool within WebCT is archival with the course backups. A plus for using this feature is all email related to a course is kept together. However, Pardue encouraged her students to use her university address, for more dependability in reply time. As the semester progresses it becomes difficult to regularly check multiple email sites.

### 5.5 My Grades

The My Grades tool allows the students to see only their own grades on-line. The instructor must choose to maintain an on-line grade database within WebCT. Then only the columns that the instructor wants to release are visible to the students. The statistics for exams can also be selected for release. Students responded positively to this tool in an end-of-semester survey.

## 5.6 My Progress

The progress tool is a quantitative visual indicator for the student to see how much of the on-line activities they have completed in the semester. This can be a motivational tool, and as such is classified by WebCT as a study tool.

## 6.0 Homework

The Assignment Tool is a WebCT Evaluation Tool. Referred to by Pardue and Darvennes as the Homework Link from the homepage, this tool allows for time-release control of posted assignments. The settings feature has fields for text with/without HTML tags, indicators for the release date and due date of the assignment, and allows selection of files to be attached to the HW assignment. On the input side, the students can upload files they need to turn in for an assignment. This is useful for collecting electronic HW such as program code. Used extensively by Pardue for every HW in Fall 2001, the upload feature for HW that allowed for on-line grading was viewed as tedious and redundant by the students in an end-of-semester survey.

### ME 2330-001 - Engineering Mechanics-Dynamics - Spring 2002

[Home](#) ▶ [HW assignment](#)

#### Assignments

Current date: Jan 14, 2002 21:50

Title	Availability	Grade Status
HW1	From: Jan 10, 2002 09:00 To: Jan 11, 2002 09:00	-- / 2 Unavailable
HW2	From: Jan 11, 2002 09:00 To: Jan 14, 2002 09:00	-- / 2 Unavailable
<u>HW2.2</u>	From: Jan 14, 2002 09:00 To: Jan 16, 2002 09:00	-- / 2 Not Submitted
<u>HW3</u>	From: Jan 14, 2002 09:00 To: Jan 18, 2002 09:00	-- / 2.5 Not Submitted
HW4	From: Jan 18, 2002 09:00 To: Jan 23, 2002 09:00	-- / 2.5 Unavailable
HW5	From: Jan 18, 2002 09:00 To: Jan 25, 2002 09:00	-- / 2 Unavailable
HW6	From: Jan 18, 2002 09:00 To: Jan 28, 2002 09:00	-- / 2 Unavailable
HW7	From: Jan 28, 2002 09:00 To: Jan 30, 2002 09:00	-- / 2 Unavailable

Figure 6. Typical HW list

## 7.0 Quizzes

The WebCT Quiz tool, and the Quiz Database are very valuable instructional tools. However, learning their full usage is a bit awkward relying only on the WebCT provided on-line documentation. Third-party software such as Respondus makes the process of posting a quiz easier. However, Respondus currently does not support the formula type question.

## 7.1 Final Exam in WebCT

In Fall 2000, Darvennes wrote a 20 question MC final in 8 hours. This was the authors' first use of WebCT and we wanted to see how long it would take to develop the test. Given our inherent dislike for grading especially on an exam that the students often never look at again, we felt the time taken up front developing the test was better spent. Not only do you save yourself the pleasure/agony of grading an exam, but the questions are now in a database and can be used in future teaching. The fundamentals of engineering exam is given in multiple choice format and therefore the authors also reasoned that passing a final in the class in this format would be good practice.

With the test being multiple-choice, partial credit was of paramount concern to the students. Students have told me the only way they pass their engineering courses is through partial credit. Should we be concerned about graduating engineers who can never quite get the right answer? In order to address concerns about partial credit, carefully crafted MC questions were written. Some of the questions had answers that represented standard flaws the instructors had jointly observed to occur. The students also expressed concern about an on-line exam. We made a paper copy backup of the questions for the test just to ensure the final would occur regardless of WebCT and possible quirks in the system. This first exam process went off with no problems for two sections of 20 students each.

## 7.2 Formula Questions

The formula type of question is a unique strength of WebCT in regards to use in engineering problems. However, one possible drawback is the formula question must be worded such that only one numerical is required. The formula for the answer must be entered in the database form fields in a stylized manner. The positive outstanding feature is that the problem statement can be made in terms of variables with ranges set for the database to calculate answers. When one student see the posted problem, it shows with one set of numbers in place of the variables, while a second student receives a second set of numbers. The answer a student submits is then automatically graded with a range of tolerance set by the instructor. So round-off error is not an issue. Note that the third-party Respondus does not support the formula option for the question type. This type of question has to be entered in the WebCT database using the on-line form pages supplied by WebCT.

Finally, the Quiz Tool lets the instructor set the release time for the quizzes, the time duration of the quiz, and the number of allowed attempts for a quiz. The student view of the Quiz page is shown in Figure 7. The underlined links are active.

## ME 2330-001 - Engineering Mechanics-Dynamics - Spring 2002

[Home](#) > [Quizzes](#)**Quizzes and Surveys** View class statistics for quizzes. View scores for quizzes.

<a href="#">Sample</a>	From: Jan 10, 2002 09:45 To: Jan 18, 2002 09:00	5 minutes	/ 3	Completed: 0 Remaining: 3
Q1	From: Jan 10, 2002 09:00 To: Jan 14, 2002 09:00	5 minutes	/ 5	Completed: 0 Remaining: 3
<a href="#">Quiz 2</a>	From: Jan 11, 2002 10:00 To: Jan 16, 2002 09:00	10 minutes	/ 4	Completed: 0 Remaining: Unlimited
Quiz3	Unavailable	---	---	---

Figure 7. Quiz list.

## 8.0 Content Modules

The Content module is an organizational tool where HTML files can be posted in a linear fashion with automatic numbering and selectable indenting of topics with subnumbers.

### 8.1 Lecture content based on PowerPoint

Using PowerPoint to help deliver lectures in the classroom is an attractive approach, especially for undergraduate courses where content will be somewhat the same from year to year. Many students have expressed concern about PowerPoint presentations in the classroom. It challenges their trained expectation that the only important notes are those that are written down on the board by the professor. The effort expended in preparing lecture notes in electronic form prior to class is necessary in the authors' view. Being able to converse with the students, to see what the student reaction is and to adjust lecture timing and emphasis are crucial for successful education. Three possible delivery options for lectures using PowerPoint are 1) The student must write down onto paper what is projected on the board, 2) the instructor provides the day's lecture (either complete or incomplete) on paper as handouts for the students to follow along, 3) the students must print out their own notes prior to class (available on-line) to make additional notes on during class.

By having the notes on the web in an easily printable form, the students can decide whether to write down everything from the overhead projector, or to make cursory notes and print out the class notes after class for later review. Ideally, the class notes would be on-line for the week in advance, so the students could print them out and bring them to class.

### 8.2 PowerPoint and WebCT

For archiving the slides on the web, PPT Office 2000 writes HTML files with frames and navigational aids that are undesirable and redundant in WebCT. Without a means to remove the frame structure, Pardue returned to PPT Office 97; it does not use frames in the HTML version of the slides. The navigational aids are still there, but unobtrusive.

Darvennes uses Corel Presentations to produce her lecture content. Initially she archived the stand-alone executables and then more recently she has begun posting the slides individually.

There are two ways of putting PPT HTML slides on WebCT within the Content modules. Initially, Pardue placed the index slide (of the HTML converted PPT slides) as the link from the Content Module page. When the student clicked on this slide, it brought up the first slide of the lecture. The students could use the built-in navigation on the slides courtesy of PPT to go from one slide to the next. When they wanted to print something off the web, they had to do so one page at a time.

An alternative way of posting the PPT slides is available in WebCT. The Compile tool lets the student select what parts of a Content module they want to compile for printing. However, just placing the index slide of the lecture in the Content Module would not let the students compile the remaining 14 or so slides in any given lecture. To effectively use the Compile tool, each slide of the PPT lecture must be placed individually on the Content Module Page.

Approximately 30 minutes per each lecture set of slides was needed for this operation. The process was to edit the PPT lecture to reflect whatever changes needed, convert it to HTML using PPT commands, remove the text version of the slides, zip the files, upload to WebCT, make a folder to house the unzipped file, unzip the slides into the new folder, go to the Content Module, add a HTML link, select the first slide, add an HTML link, select the second slide, etc., check titles of the slides showing in the Content Module (title comes from the upper title of the slide in the PPT), indent slides appropriately, and finally update the WebCT Content Module.

With the HTML version of the lecture slides posted, the ensuing semesters adjustments are fun. Links from each Content page can be easily added. For example, adding learning objectives to each content page through a built-in goals tool enables students to place detailed content into an overall conceptual map of the course.

## 9.0 Timeline for Success

Lest one thinks the process of augmenting a class with on-line material is achieved in one semester, a timeline outlining the authors' process using WebCT or other electronic tools is provided.

1. Spring 2000
  - a. PowerPoint lectures made from content developed in Fall 1999
  - b. Stored PPT on-line in self-authored FrontPage website
  - c. Used WebBoard for discussion
2. Summer 2000
  - a. Studied the use of WebCT with TTU pilot group
  - b. Attended ASEE Conference and WebCT Conference. Looked for best practices and technical usage of on-line tools.
3. Fall 2000
  - a. TTU WebCT Pilot group meet every two weeks
  - b. Vibration lecture content archived on joint FrontPage website
  - c. WebBoard for class discussions, posting Homework assignments and solutions

- d. Final Exam issued in WebCT for two sections of vibrations
- 4. Spring 2001
  - a. Vibrations: switch over to WebCT
    - i. Archived some lecture content
    - ii. Posted HW solutions and assignments
    - iii. Class discussions
    - iv. One Exam issued on-line, synchronously in computer lab
    - v. Final Exam issued on-line
    - vi. Two reading quizzes
  - b. Dynamics: WebCT course site designed and used for
    - i. Archiving lecture content
    - ii. Assigning HW and posting solutions
    - iii. 4 Quizzes over basic concepts
    - iv. Final Exam issued on-line
- 5. Fall 2001
  - a. Vibrations:
    - i. All lecture content archived as semester progresses
    - ii. Use of Homework tool to make assignments
      - 1. Students required to upload an answer summary sheet for each of 17 HW sets through the semester
      - 2. MATLAB files and figures are uploaded to the HW assignments by students
      - 3. Homework tool allows for the instructor to easily attach file for the assignment
    - iii. Two Exams issued on-line asynchronously
      - 1. Exam released for 24 hours
      - 2. Students have two hours to complete, once exam is initiated
      - 3. Exam questions are formula type
    - iv. Final Exam is synchronous in the computer lab
      - 1. A 60 concurrent-user license for MATLAB on TTU campus means limited class sizes are recommended for simultaneous testing; there is a chance larger sections, greater than 35, will find some students without access to MATLAB
    - v. Practice exams are made available on-line for self study
    - vi. Content Modules
      - 1. 5 Modules based on class organization as outlined in 2001 ASEE paper, "A Modular Approach to Vibrations"
    - vii. Calendar
      - 1. Exam dates
      - 2. HW Due dates
      - 3. University closings
    - viii. Discussion Board
    - ix. Whiteboard
      - 1. Used on Tuesday and Thursday Nights
      - 2. Weekly S. Pardue met ~15 students on-line to discuss HW

- b. Dynamics:
  - i. Base lecture content is archived on-line
  - ii. Lectures are typically 15-20 minutes with 6 slides (at most 9)
  - iii. Content Module
    - 1. 1 Module
    - 2. 150 HTML pages
    - 3. Link to Quizzes
  - iv. Calendar
    - 1. Links to Content Module for daily class material
    - 2. Quiz due dates
    - 3. HW Due Dates

## 10. WebCT Web Resources

The corporation homepage for WebCT [www.webct.com](http://www.webct.com) provides links to publishers with e-packs, electronic packages of information typically tied to large usage publications. These e-packs are designed for direct use in WebCT without significant modification. A search for engineering course content e-packs shows 12 texts, only one of which directly applies to the mechanical engineering courses, Engineering Mechanics: Statics and Dynamics, 9e, Hibbeler. In contrast, a larger amount of electronic materials is ready for the electrical engineering field.

## **BIBLIOGRAPHIC INFORMATION**

Pardue, "A Modular Approach to Vibrations," 2001 ASEE Annual Meeting and Exposition, June 24-27, 2001, Albuquerque, New Mexico.

## **BIOGRAPHICAL INFORMATION**

### SALLY PARDUE

Sally Pardue is an Assistant Professor of Mechanical Engineering at Tennessee Technological University. She began her academic appointment in August 1999 following four years as a Research and Development Engineer. Dr. Pardue received her PhD in Engineering from Tennessee Technological University in 1995. Her research interests are random vibrations, machine diagnostics, cavitation, and NDE of composite materials.

### CORINNE DARVENNES

Corinne Darvennes is an Associate Professor of Mechanical Engineering at Tennessee Technological University. Dr. Darvennes received a Diplôme d'Ingénieur of Mechanical Engineering from Université de Technologie de Compiègne, France, in 1984, an MSc from the Institute of Sound and Vibration Studies, Southampton, England, in 1985, and a PhD in Mechanical Engineering from The University of Texas at Austin in 1989. In 2000, she became an INCE Board Certified Noise Control Engineer.