

AN APPLICATION OF MULTIMEDIA IN TEACHING MECHANICAL VIBRATIONS

A. Malalasekera Dept. of Aeronautical and Automotive Eng., Loughborough University, U. K.
S. J. Walsh Dept. of Aeronautical and Automotive Eng., Loughborough University, U. K.
T. J. Gordon Dept. of Aeronautical and Automotive Eng., Loughborough University, U. K.

1. INTRODUCTION

This paper describes a multimedia teaching package developed during a 2 year pilot project at Loughborough University. The aim of the pilot project was to convert a number of lectures on the part time residential M.Sc. course in Automotive Systems Engineering into computer based distance learning material. The application of innovative technologies such as multimedia and hypertext was a main interest of the project. One specific objective was to develop a multimedia computer based lecture presentation. Use of video taped lectures was discounted as tape recordings do not provide the same degree of flexibility and would require a tutor to provide supplementary explanations. A number of subjects from the M.Sc. course were converted into traditional text based distance learning material including mechanical vibrations, combustion and signal analysis. To support the text based material, multimedia teaching packages were also developed. Towards the end of the pilot project, the format of the M.Sc. course was changed and distance learning elements were introduced into all of the taught modules. Further details in the development of the new course format are given in reference [1]. Around 30% of each module is now delivered in distance learning format as pre- and post-residential study material. Distance learning material developed during the pilot project is now used by students to support their study in subjects such as mechanical vibrations. The aim of this paper is to describe the development of the multimedia teaching package on mechanical vibrations.

2. DEVELOPMENT OF THE MULTIMEDIA PRESENTATION

2.1 Video Recording

When the pilot project started the taught course element of M.Sc. in Automotive Systems Engineering was entirely residential. Therefore, it was decided to video record a number of lectures so that a permanent record of the lecture room environment would be available. The classroom lectures were recorded by placing video cameras at the back of the lecture room so that the students would not be disturbed by the camera crew. Lecturers were asked to wear a wireless microphone during the lecture in order to get a clear audio signal onto the video tapes. When Students spoke in the lecture room the video camera microphone recorded their questions. From examination of the video recordings of a number of subjects it was decided that mechanical vibrations would be a suitable topic for a multimedia presentation. The next step was to chose software to develop the multimedia package. It was decided to use a commercially available and easy to use multimedia authoring tool.

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2.2 Designing a Template for the Screen Presentation

The multimedia authoring package Macromedia Authorware version 3.5 was chosen as the development software. Authorware provides tools for creating multimedia presentations that use text, graphics, sound, animation and digital movies. With Authorware, the multimedia presentation is constructed by assembling icons on a flowline. In order to integrate the various elements of the lecture material it is necessary to construct a template. Before constructing the template several issues needed to be considered. Firstly, it was necessary to decide which navigation facilities needed to be included in the teaching package in order to make it easier to use. To provide a smooth flow of information a given segment of lecture material should run continuously without the user entering data from the mouse or the keyboard. On the other hand the user may need the flexibility to control the flow of the lecture material in order to study at their own pace. Therefore, it was decided to provide a facility to select either continuous play mode or the manual mode. The multimedia package should also cater for students learning the lecture material for the first time and in addition for students revising the subject. Therefore, a facility was provided to jump to certain sections of the lecture without going through all the stages in between.

2.3 Developing the Storyboard

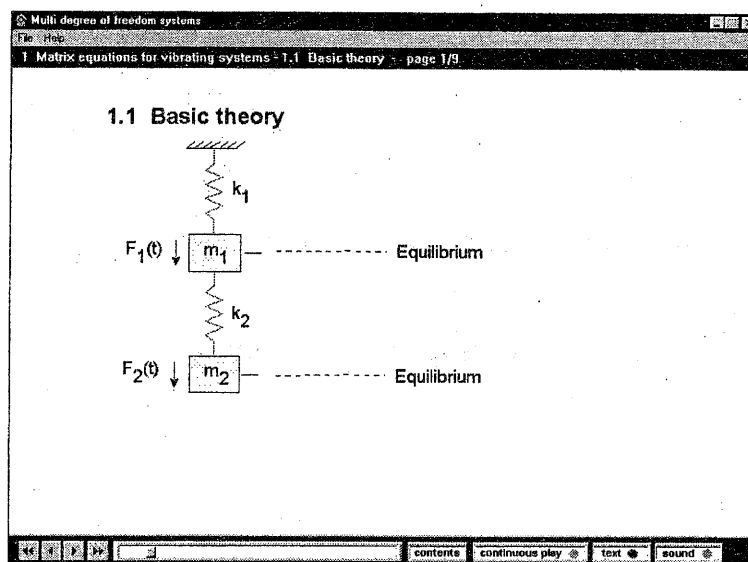
A storyboard, or frame by frame sketch, was prepared in order to assist the development of the multimedia presentation. The audio track of the video taped lectures was transcribed onto paper to obtain a written record of the spoken lecture. This proved very useful in building the storyboard. The video tapes were referred to frequently in deciding where to apply computer animation in the lecture presentation. The amount of material which can be presented on one page of the multimedia presentation is dependent upon the size of the presentation window which is set by selecting the screen size in the Authorware file set-up. With Authorware v3.5, the content of a presentation window will not automatically be re-sized when the screen size set-up is modified. Therefore, it was essential to decide the required screen size before starting the storyboard. For this work, a screen size of 800 x 600 pixels was chosen. Enough space was left at the top and the bottom of each presentation window to display the where am I indication bar and the navigation button bar. To maintain a similar look and feel throughout the presentation, a style guide was prepared specifying a preferred format for items such as font size, font type and background colour. Once the storyboard was developed, the next task was to develop the screen presentation by integrating various elements of the lecture material into the template.

2.4 Developing the Screen Presentation

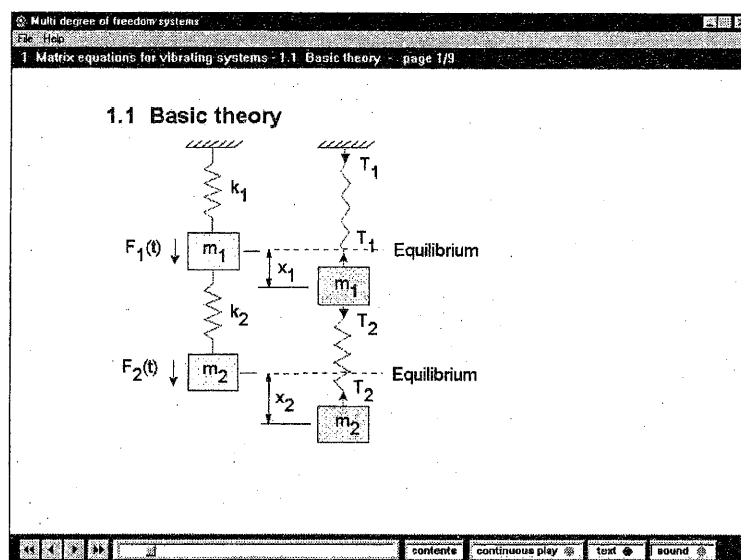
An individual page of the multimedia package was created by gradually adding the text and graphics into consecutive presentation windows. In most cases, a given presentation window contained very little text or graphics. Pauses were introduced into the flowline between presentation icons so that the text and graphics appeared on the screen at a similar pace to that of the classroom lecture. The wait icons provided in Authorware were used to introduce pauses. A completed presentation window is known as a page. Text and graphics were added to the consecutive presentation windows as before in order to complete the next page. Using this method the entire lecture presentation on mechanical vibrations was constructed. Due to this design feature users can go straight into any page and play it. This is particularly useful when revising the lecture material.

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An example of the lecture presentation in run mode is shown in Figures 1(a) and 1(b). To aid navigation through the material the chapter number, section number and page number appear at the top of the page together with an indication of the total number of pages in that section. Upon completion of a page, the presentation screen was cleared except for one or two of the last items. These items were then moved to the top of the new page to maintain the continuity of the lecture presentation.



(a) First presentation window



(b) Second presentation window

Figure 1: Lecture presentation in run mode.

2.5 Adding Sound to the Presentation

To provide audio as well as visual features in the multimedia presentation, voice scripts were developed. The previously transcribed audio track from the video recording of the lecture material was edited and used as a basis for the voice scripts. Each sentence was treated as a separate voice script. The lecturer was asked to re-record the relevant voice scripts onto an audio tape. These were then captured into a computer and saved as 16 bit sound files. The sound files were edited to remove long pauses and unwanted noises. Each sound file was then integrated into the presentation flowline. Audio visual synchronisation was done manually by adding wait icons into the flowlines and by adjusting the wait time of existing wait icons. The wait time for each wait icon was determined by the trial and error method of playing a very small section of the audio-visual presentation while adjusting the wait time until the visual screen presentation was synchronised with the voice. Figure 2 shows an example flowline of the synchronised audio-visual presentation.

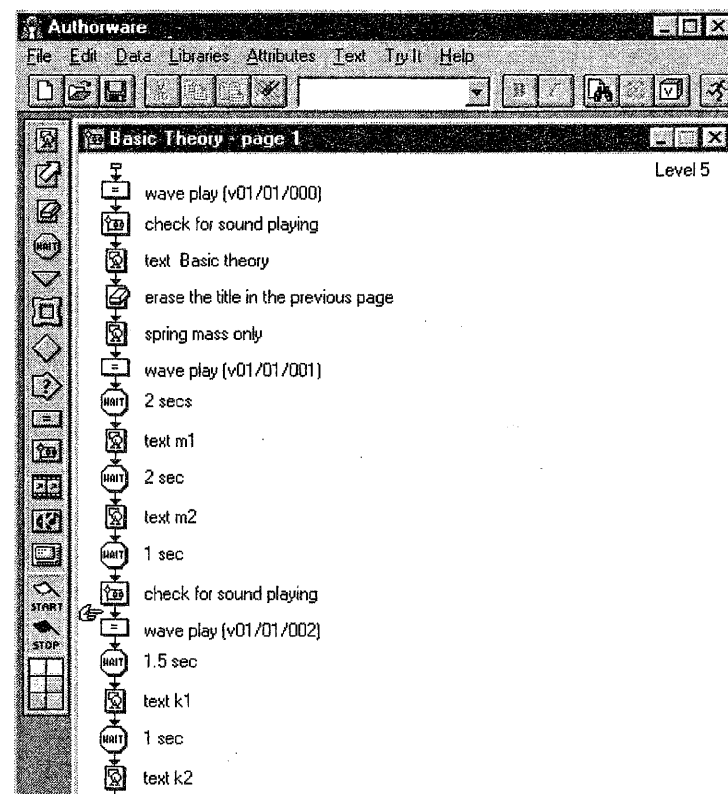


Figure 2: A flowline of the synchronised audio-visual presentation.

3. USE OF THE MULTIMEDIA PRESENTATION

3.1 Operation

A complete package has been developed which provides a visual screen presentation of lecture material in mechanical vibrations synchronised with an audio track of the lecturer's voice. The pace of the lecture presentation is controlled by switching between play modes. If the continuous play mode is invoked the lecture presentation will run at its own pace until it reaches the end of the section. If the continuous play mode is off, then a continue button appears automatically at the end of each page allowing the user to proceed when ready. The continuous play mode can be changed at any point of the presentation. Similarly, the lecturer's voice can be switched on or off during the presentation.

Navigation facilities are provided such as replaying the current or previous page, pausing the presentation, and moving to any other page in the same section or in another section. At each stage of the lecture presentation the chapter number, section number and the page number are displayed together with the total number of pages in that section. Users are not required to input any data or answers during the presentation. For example, assessment exercises are not included within the multimedia teaching package. However, self assessment questions are included in the accompanying text based distance learning material.

3.2 Evaluation

Evaluation of the presentation was conducted in two stages. In the first stage a number of staff who were familiar with the development of distance learning material but who were from non-engineering backgrounds were asked to check the lecture presentation for consistency of the style. They were also asked to comment on the general appearance of the presentation. In the second stage, subject specific evaluation was carried out by the Ph.D. students studying mechanical vibrations at the University. They were asked to comment on the appropriateness of the subject matter and to proof read the contents of the presentation.

3.3 Distribution and Feedback

The multimedia package on mechanical vibrations was distributed to students together with the accompanying text based distance learning material as part of their pre-residential study for the first module in the M.Sc. course. The distance learning material was supported by classroom based lectures and tutorials during the residential week. Feedback from students on the multimedia presentation was very positive. It was reported that the multimedia package made it easier to understand the text based lecture material and also allowed control of the pace of the lecture delivery. However, students felt strongly that they also needed the text based material for their future studies.

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4. SUMMARY

This paper has outlined the development of a multimedia lecture presentation in mechanical vibrations. Currently the presentation is being used by students as part of the distance element of the M.Sc. course in Automotive Systems Engineering. The lecture presentation was developed using a commercially available software tool. The complete presentation includes text, graphics, audio, and animation. Each section can be run continuously from start to finish or, alternatively, individual pages can be played and replayed as required. Initial feedback from students on the multimedia presentation has been very encouraging with many reporting that it made the traditional text based distance learning material easier to understand and gave them control over the pace of lecture delivery.

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