A Virtual 3-D TAPS Package for Solving Engineering Mechanics Problem

S. Manjit Sidhu
Informatics Department, COIT,
Universiti Tenaga Nasional (UNITEN),
Km-7, Jalan Kajang-Puchong, 43009,
Kajang, Selangor.
manjit@uniten.edu.my

N. Selvanathan
Faculty of Computer Science & IT,
Dept. of Software Development,
University Malaya, Malaysia.

Abstract - This paper describes an approach to implementing technology-assisted problem solving (TAPS) package using desktop virtual reality interface that brings together a 3-D model of an engineering mechanics problem in an interactive manner. It provides the user with a self-study environment in which to solve an engineering mechanics problem in a mechanical engineering course. The package guides the user to solve a problem in a step-by-step approach in a graphical environment. Components such as 2-D, 3-D and stereoscopic images are integrated to provide dynamic learning environment and guidance so that the learners can analyze the necessary actions to be taken in the virtual environment. Preliminary evaluation indicated that the TAPS package has great potential to aid teaching and thus provide an effective learning environment particularly for slow learners.

Keywords: Multimedia, virtual reality, interactive, 3-D

1 Introduction

Technology-assisted problem solving (TAPS) packages can be defined as highly interactive, computer based virtual learning environments that employ multimedia and virtual reality (VR) technologies. Students initially use these TAPS packages to assist them in their learning. As such a TAPS package was implemented for this study to test the feasibility of this technology as an aid to supplement slow learners (learners who are weak in the subject matter) in an engineering subject. The TAPS package implemented for this study is an intelligent virtual coach that can be used by slow learners to learn how to solve the selected engineering mechanics problem in a step-by-step approach. In a previous study we used the concept of coach to solve an engineering mechanics dynamics problem in a multimedia environment. More details on this study can be found in [1].

Multimedia and VR has shown great potential as a media in enhancing engineering education [2-4]. The success of these technologies in engineering education however lies in the development of effective and user-friendly TAPS packages [5-7].

Engineering mechanics is a core subject that is being taught at the undergraduate level for both the mechanical and civil engineering in UNITEN. Past experience indicated that students generally find the theories involved in this subject confusing mainly because of the dynamic nature of problems that requires the student to visualize as well as to have a certain depth of understanding. Consequently, one of the early objectives of TAPS package was to provide an environment that could help the student solve mechanics problems without the help of a human instructor. In addition the TAPS package could further provide more classroom time for demonstrations and coverage of conceptual issues. The focus of this study is to investigate whether such a learning package could enhance understanding and be effective as a self-learning aid particularly for slow learners.

2 Multimedia and VR Applications in Education

Within the higher education settings, multimedia is being employed with increasing success. Multimedia based packages provide the student with a very rich source of educational material in the form that makes learning interactive and engaging. VR has extremely wide applications across a whole range of disciplines, and the enabling technology has reached a sufficient level of maturity for it to be seriously applied to education, training and research education. However, until fairly recently VR systems have not had the performance to be seriously considered for anything other than research tools. Furthermore, the cost associated with a VR system have been prohibitive for educational establishments (especially for fully immersive VR systems). However, recent technological developments in computer hardware and software has made it feasible to employ desktop VR (non immersive) as an important teaching, learning and visualization aid.

It is certain that the flexibility provided by a VR system will be a major attraction to the educational community.