Chapter 12
Purpose-Oriented Small Software:
A Case Study for Some Engineering Subjects

Giancarlo Anzelotti
University of Parma, Italy

Masoumeh Valizadeh
University of Guilan, Iran

ABSTRACT

This case emphasizes on the power of virtual tools for engineering subjects. As a more accessible approach, the authors suggest the development and application of Purpose-Oriented small software. The aim of developing these e-tools is enhancing the understanding of concepts taught in the undergraduate and graduated Mechanical, Material, Civil and many other engineering branches. The main idea behind this case is to show that even light software which is focused on a particular subject can be used as a key for engineering education.

INTRODUCTION

The critical tenet of engineering education reform is the integral role of virtual environment capabilities which is provided by fabulous advances in information technology. Current technological progresses combined with changes in engineering content and instructional method require engineering instructors to be able to design intensive and concentrated lessons for exploration and discovery of the engineering concepts through appropriate computer applications. In actual practice, however, most computer applications provided for engineering education consist of software designed for a specific educational purpose. Furthermore, economical constraints often stand in the way of incorporating such special purpose software into an instructional setting.

Owing to all the revolutions made and is being made in information transfer and computer capabilities and speed, recent decades have been witnessed many changes in the methods of engineering education and there are many new researches and methods for this task (Willis 1993; Koksal 1998; Kaufman 2000; Cloete 2001; Wankat 2002; Baker 2005; Hutten 2005; Yu 2006; Burnely 2007; Moreno

DOI: 10.4018/978-1-61520-869-2.ch012

2007; Haghi 2008; Monahan 2008; Shih 2008; Toth 2008; Vadillo 2009). This paper discusses an alternative to the traditional approach which shifts the instructional focus from specific computer applications to more sophisticated uses of general purpose software. In particular, educational uses of purpose-oriented small software which can be implemented in multi purpose software are exampled as an introduction to this approach. In another vision, purpose-oriented small software can be designed as a cost-effective approach to provide practical experience to undergraduate students. The concept which is called '*Virtual Laboratory'* and is being widely developed in engineering schools and educational programs (Gervasi 2004; Ramasundaram 2005; Kukreti 2008; Tan 2008; Vadillo 2009).

The software and approaches described here have been presented to graduate and undergraduate engineering education majors in a continuing education course in universities or factories.

NEW APPROACHES IN ENGINEERING EDUCATION

Since the first years of its emergence in mid 20th century (1940-1945), the computers have been welcomed and started to be employed by governments, companies, factories and moreover in education. By this new invention of human being the computations needed the handling of big amount of data and calculations have been "translated" in computer language and little by little have been automatized and implemented by this powerful contrivance. It changed the approach to design radically and convinced the engineers, mathematicians, economists, industrialists all over the world to employ it as a potent tool in their activities. Since that time we have been witnessing significant jumps in the science of computing and design. Nowadays, thanks to the enormous power of today's computers respect to what was available just few years ago, we are able to solve complex, multifarious tasks involving different science fields and may need weeks or months of work if they would have been done by hands.

Along with the significant changes in designing and calculating methods, occurred through the application of electronic devices like calculating machines as a simple example, but mostly the computers, the methods of teaching the design and modeling techniques have changed remarkably. However comparing to all the present branches of science and technology, the engineering and engineering education have evolved more and have progressed fabulously. Nowadays the use of computer-aided design software (CAD) or finite element systems (FEA) have become *de facto* a standard and the essential topics in engineering courses, both at school and university levels. In the next step, further improvements in the field of computer languages has made the use of custom-made software more widely possible, and has empowered the engineers to solve different requirements of the industries.

Professional programming languages like Python™ or Visual Basic® have been developed with a reasonably user friendly, easy learning curve and practical performances, providing lower investment costs for users. On the other hand to confront with more complicated calculations middle-level languages like C++ or High-level languages like FORTRAN represent a fairly better performance in a more admissible time. Furthermore, concerning to the fact that the software may be used in different operating systems and to aid the students to use them in laboratory or at home then a cross-platform programming approach consisting of languages, tools, libraries, etc. that let the programmer to port easily the code from one operating system to another one can be more favorable.

However, the field of education is usually concerned about the understanding of concepts as well as how to speed-up the learning process, where the ease of knowledge transfer from the teacher to the students is the key issue. In this