Teaching Strategy Based on Interactive Use of Computational Programs

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Abstract: Computer-assisted teaching and learning has expanded greatly in the last few years. It has also been implemented very efficiently in our physics course and seminars, alongside the use of the Internet. We have developed our own strategy for solving problems and studying physics phenomena based on Maple and Mathematica software. These computer algebra systems assist the students finding solutions and performing length calculations, and also bring the studies alive with animations and simulations.

Keywords: computer assisted instruction, teaching methods, computer science, problem solving, students

1. Introduction

The new trends in modern teaching and learning of engineering physics show that computer algebra systems like Mathematica and Maple \[1\] are very useful for physics studies, and assist the students in acquiring a better strategy for learning physics and solving problems making use of a symbolic computing engine. We have chosen to incorporate these powerful computational programs into our courses and seminars for students who major in technical fields, for the study and demonstration of physics concepts and phenomena, for performing calculations and generating numerical and graphical solutions to physics problems. We have also developed a teaching strategy based on the interactive study of physical phenomena and computational methods, which uses these programs \[2\], \[3\], \[4\], and have implemented a permanent communication with the students and among them via the Internet for exploring, learning and applying mathematical methods in physics.
2. Teaching Strategy, Maple and Mathematica Applications.

The main direction of our teaching strategy is to teach students how to operate and realize an interactive use of adequate software. We have implemented in our course and seminars Maple and Mathematica programs to create an environment for a deeper study of physical phenomena. These platforms present some advantages as flexibility and speed, and many advanced graphical facilities. To obtain good performances we have optimized continually the applications and acquired the newest versions of the programs.

We use Maple and Mathematica applications for classical mechanics, oscillatory motion, waves, fluid dynamics, electromagnetic field, light interference, diffraction, and polarization, thermal radiation, photoelectric effect, Compton effect, and quantum mechanics. The applications enable the students to verify what they have learned by testing their understanding of the concepts and phenomena. Also, they provide an efficient way for solving physics problems, plotting using many options and producing animated graphs with a large spectrum of choices. In addition, we use Mathematica for producing simulations.

3. Discussion

We apply a teaching-learning strategy with long term application for improving our physics course and seminars. We have implemented Maple and Mathematica programs and we provide the students with a powerful learning strategy and encourage the improvement of their knowledge. In this way, our courses and seminars can be carried out at a higher level, as computer algebra systems have a great impact on the educational process. An interactive computer based education improves the effectiveness and efficiency of teaching and learning process and allows the students to integrate better in society.

References