

Maple as a Tool for Selfstudy and Evaluation

T. Kolokolnikov, Norbert Van den Bergh
Faculty of Applied Sciences, University of Ghent, Belgium
e-mail: Norbert.VandenBergh@rug.ac.be

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Abstract

We present software developed at the University of Ghent within the framework of the ALICE-project and we report on the results obtained so far.

ALICE (Active Learning In a Computer Environment) self-study modules in linear algebra, calculus and theoretical mechanics have been in use for over four years at our institute's Faculty of Engineering. Each module consists of a collection of Maple worksheets, containing theoretical materials, worked-out examples and exercises. For exercises which require symbolic answers or in which the verification of the answers involves complex mathematical operations, the use of a computer algebra package is an indispensable tool. A typical such question is to compute a basis for the vector space of all trace-free 2x2 matrices. Both $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$, $\begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$, $\begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}$ and $\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$, $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$, $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$, (as well as infinitely many other choices) are correct answers for this question. Grading this question requires type conversion and some elementary linear algebra operations - things that Maple is good at.

In order to include these and similar possibilities in modules for self-evaluation, a fast and powerful web-server was developed: the Alice Interactive Mathematics (AIM) server. The distinguishing features of AIM are its use of Maple as the engine and implementation language; versatility in question and quiz design, including the randomisation of quizzes and questions; its visualisation of mathematical formulae without the use of GIF-images; the speed with which individual quizzes are generated; various feedback mechanisms; facilities for giving partial credits; its extensive grade reporting and monitoring capabilities; its ability to collect surveys and its web interface for both teacher and student.

AIM has been used as a self-evaluation tool for a class of about 300 students taking vector calculus. The results so far have been encouraging and AIM will be used this year for the first time to administer also the final exam for the linear algebra course in the Faculty of Engineering.

AIM is currently being used at two different universities and one college in Belgium and by three universities in the United Kingdom. The AIM server is implemented using Maple (90%) and Java (10%) and can be installed on any Windows computer that has Maple V and an internet connection. It is freely available.