

# Wortel TU/e

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## 1 Introduction

Every year students enroll into one of the bachelor or master programmes of the TU/e. Their backgrounds may be very diverse. In particular, a substantial variation in mathematical skills occurs. To deal with these differences and to be on the safe side, there is a tendency to start mathematics courses with material that students should have mastered previously to some extent. In this way, instructors make sure all participating students are properly prepared when they start with the core topics of the course. Disadvantages of this approach are that these preparatory parts are usually done in an ad hoc manner, and that they may take a substantial amount of time.

For this reason, TU/e has launched the project ‘Wortel TU/e’, run by our group. In Dutch, Wortel TU/e is an acronym: Wiskunde Onderwijzen, Repeteren, Toetsen En Leren aan de TU/e (Mathematics: teaching, practicing, testing and learning at TU/e); the word ‘Wortel’ is also the Dutch

word for root. The improvement compared to the existing situation lies in offering a coherent package of interactive test and learning material that can be used prior to the start of the regular courses. Below, we sketch Wortel TU/e in more detail and show that the project is related to other projects in the Netherlands which deal with similar problems. Also, there are efforts to organize these projects on a higher level as we will indicate below.

## 2 Wortel TU/e

Wortel TU/e's primary aim is to smoothen the transition from high school mathematics to university mathematics in a systematic way, and with the latest insights and techniques. Wortel TU/e provides web based material to locate students' deficiencies, teaching material, and test material. More precisely, Wortel TU/e focuses on:

- Online interactive material for the upper grades in high schools, and for university freshmen, mainly in the areas of calculus and linear algebra.
- Online examination and exercise material, provided with a feedback mechanism for instructors.

At present, all necessary technology is available, either from other parties or developed by our group (for instance, Wortel TU/e is built upon our system MathDox [5]). But the web material we aim for is as yet incomplete. See <http://wortel.tue.nl/> for an impression of Wortel TU/e (in Dutch, however).

### **Online material for highschools**

Wortel TU/e provides online interactive material for highschools, in addition to the regular highschool mathematics material. On the one hand it intends to motivate students with the possible ambition to take up a study for which sound mathematical knowledge is required. On the other hand it is intended to enable prospective students to familiarize themselves with the precise basic requirements for mathematical courses. In this way, students are stimulated to take an active role in their preparation for university.

### **Online freshman courses**

In the same vein basic lecture material like calculus and linear algebra courses, and possibly others, will be set up, with extensive cross referencing within all of Wortel TU/e's material.

### Exercises and tests

All material comes with extensive interactive exercises and testing possibilities: both open and closed questions. To verify students' input, the Wortel TU/e system makes use of computer algebra systems, such as GAP, Maxima, WIRIS, Maple, and Mathematica [6, 7, 8, 9, 10]. (By the way, users are not aware of the presence of these systems. In particular, no specific knowledge of such systems is required of the students.) Wortel TU/e also aims at incorporating tests to find out students' mathematical weaknesses. In particular, these diagnostic tests will pinpoint the weak spots and refer the user to Wortel TU/e material covering the corresponding mathematics.

## 3 Relevant educational communities

In this section we briefly explain how Wortel TU/e relates to educational communities. TU/e is a university of technology located in the south of the Netherlands. It recruits most of its students from the southern part of the country. Part of Wortel TU/e's efforts consists in creating a community of highschoools in the region, participating in the project by doing pilots with the material, suggesting improvements, and thinking about effective uses of the material. In this way we aim at setting up a local community where both high school teachers and university instructors are involved.

Furthermore, Wortel TU/e participates in the Dutch national project NKBW, the Nationale Kennisbank Basisvaardigheden Wiskunde, i.e., the National repository for basic skills in mathematics, which aims at organizing local initiatives on a national level, such as Wortel TU/e and the project *MathMatch* [1] run by the University of Amsterdam, the VU University Amsterdam, the University of Twente, and Saxion University of professional education. The project has 13 partners (ten universities and three universities of professional education) and runs from November 1, 2006 until December 1, 2007. NKBW's ultimate purpose is to make all material produced by the partners publicly accessible through its repository website [3]. The wizmo website is both for (prospective) students and teachers/instructors. It provides search facilities in the project partners' material and several mathematics course books used in the Netherlands. It also provides access to a forum, aimed at answering mathematical questions that users might have.

## References

- [1] Project *MathMatch*, <http://www.mathmatch.nl>
- [2] NKBW (Nationale Kennisbank Basisvaardigheden Wiskunde (National repository for basic skills in mathematics)), <http://www.nkbw.nl>
- [3] Repository for NKBW material, <http://www.wizmo.nl>
- [4] Project Wortel TU/e, <http://wortel.tue.nl>
- [5] MathDox, <http://www.mathdox.org>
- [6] GAP, <http://www.gap-system.org>
- [7] Maxima, <http://maxima.sourceforge.net>
- [8] WIRIS, <http://www.wirisonline.net>
- [9] Maple, <http://www.maplesoft.com>
- [10] Mathematica, <http://www.wolfram.com>