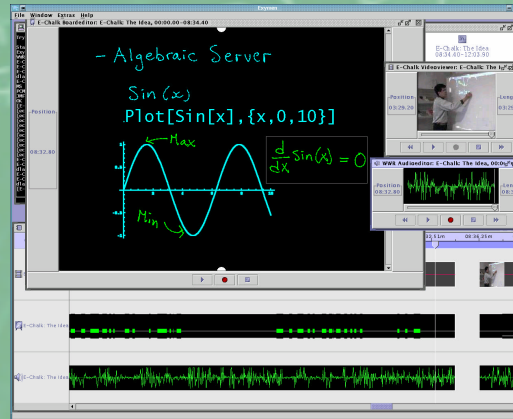


The E-Chalk formula recognition engine



Editing an E-Chalk lecture with Exymen



Pen Computing in the Classroom

## Handwritten Formula Recognition

E-Chalk can recognize the characters written on the board. This feature can be used to index lectures by keywords or to recognize and execute mathematical formulas. The E-Chalk formula recognizer is the most powerful on-line recognizer currently available.

## Editing E-Chalk Lectures

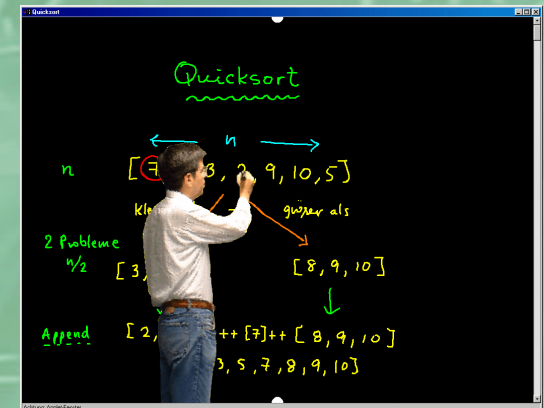
Exymen is our editor for the optional post-production of E-Chalk lectures. Using Exymen, lectures can be restructured, portions can be erased or overwritten. New sound tracks can be added or lectures can be translated into another language. Slide presentations for the Internet can be enriched with sound.

## E-Chalk in Education

E-Chalk is being used by universities in Europe. The Technical University of Berlin, for example, teaches mathematics courses for 1500 engineering students in eight E-Chalk equipped class rooms. Pupils from Berlin high-schools in the CidS project are being taught with our software.

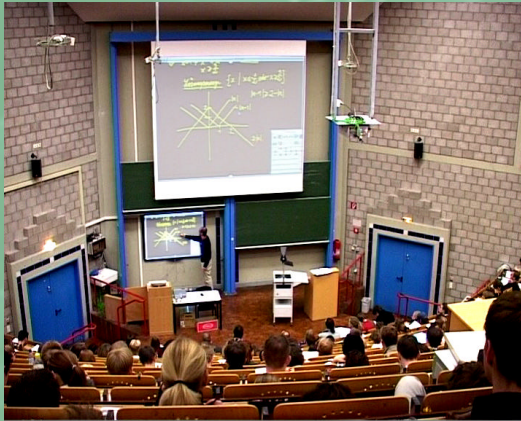
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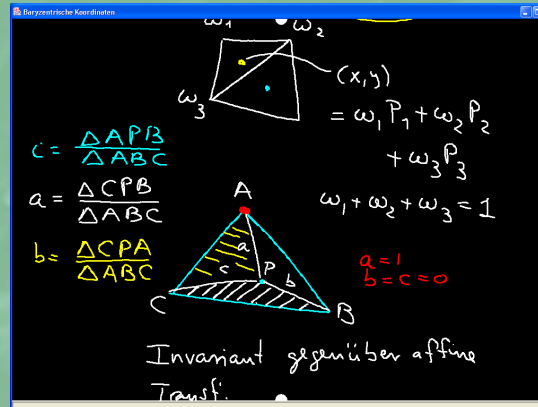
Mathematics lecture at the Technical University of Berlin using a contact sensitive whiteboard and a large projection

## Motivation

Teaching with a chalkboard leads to different kind of lectures as when using static computer slides: the teacher thinks aloud and cannot proceed too fast, the students can follow the lecture and are more motivated to ask questions. The lecturer has to be more dynamic. In the sciences, in particular mathematics and physics, the chalkboard has been at the center of teaching for centuries.

E-Chalk brings the traditional chalkboard into the digital age. It is software that transforms a whiteboard into an electronic teaching aid. In the classroom, the lecturer writes on the electronic whiteboard using a special stylus, as if it was a piece of chalk. Rear projection systems can be used, but also simple

digitizing tablets and tablet PCs, together with an LCD projector. The hardware for electronic chalkboards is becoming more affordable from year to year - E-Chalk is the software for powering such chalkboards of the future.



Replay of an E-Chalk lecture

## Features

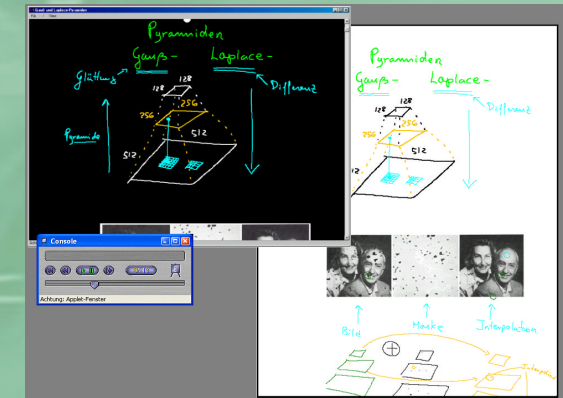
With E-Chalk, the lecturer can

- draw with different colors and line thicknesses,
- paste images from the Internet or from the hard-disk; annotate the pictures,
- plot mathematical functions,
- evaluate mathematical expressions on the fly using handwriting recognition,
- request services from Internet servers and paste the result of the query to the board.

## Storage and Transmission

E-Chalk lectures can be stored and transmitted live over the Internet. Three streams are sent: the dynamic board image in full resolution, the audio signal from a microphone, and an optional video of the lecturer.

Students can replay E-Chalk lectures stored on our server and can print a transcript of the board image in PDF format. E-Chalk lectures can be received live in laptops, PDAs and even Java enabled cellular phones.



Replay of an E-Chalk lecture, and PDF transcript

Since E-Chalk is written in Java, the student-viewer can use any Java enabled browser to play a lecture on a Windows or Linux machine, as well as on Mac-Intosh. Lectures can also be exported and played using the Windows Media Player.