Plenary, Invited Papers, and Special Session

Abstract for 13005
Modeling with real data and technology
Authors: Keng Cheng Ang
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Keywords:

There are several ways in which the teaching and learning of
mathematical modeling may be motivated. In this paper, we describe
how real data, together with technology, can provide a rich
environment for mathematical modeling activities. Examples on
modeling tasks for students at different levels are presented and
described in detail. These examples not only illustrate the use of
real data and technology in mathematical modeling activities, they
also underline the importance of keeping such tasks in relevant
contexts to provide added motivation for students.

Abstract for 13018
*MuPAD for the Classroom - A Discussion on Using Computer Algebra
Systems in Teaching Mathematics*
Authors: Miroslaw Majewski
Affiliations: New York Institute of Technology, Abu Dhabi Campus,
SciFace GmBH, Paderborn, Germany
Keywords:

It is well known that Computer Algebra Systems (CAS), for instance
Mathematica, Maple, MuPAD or Derive, provide computational power to
solve many mathematical problems faster and more efficiently than
using the old paper-and-pencil methods. The availability of such
software and its ability to deal with most undergraduate mathematics
problems cannot be ignored. A mathematics educator cannot stay
neutral in this issue. Indeed, the emergence of such software has
divided mathematics educators into two almost separate groups -those
who believe that we should use such software in teaching mathematics
as much as possible, and those who think that we should completely
 avoid technology in mathematics classes.

In this paper we will analyze various points of view on using CAS in
teaching mathematics. We will show how some of the major concerns
can be overcome. Finally, we will discuss the MuPAD for the
classroom project, where the main objective is to develop a
comprehensive set of materials to help educators incorporate MuPAD
efficiently into undergraduate mathematics teaching. Most of the
issues discussed in this paper are related to teaching high school
mathematics. In a few places we will also consider the university
point of view. However, it is important to note that in many
aspects, the CAS situation at the university is quite different than

in high school.

Abstract for 13025

Spreadsheets in Mathematics: Accessibility, Creativity, and Fun
Authors: Deane Arganbright
Affiliations: currently retired
Keywords:

A spreadsheet, such as Microsoft Excel, provides educators with a creative tool for the study and teaching of mathematics, mathematical modeling, and mathematical visualization. It enables students to gain mathematical insights into a diverse range of interesting and significant applications in an engaging setting while they simultaneously acquire practical skills in using the principal mathematical tool of the workplace. This paper illustrates novel ways to use this powerful and accessible tool and its outstanding graphic features creatively in teaching a surprising number of mathematically oriented topics. Illustrations come from such disciplines as the physical and social sciences, statistics, mathematics, computer sciences, and the arts. The paper describes how Excel's graphics can create eye-catching animated graphic displays and inject more fun into the study of mathematics.

Abstract for 13038

From String Art to Caustic Curves: Envelopes in Symbolic Geometry
Authors: Philip Todd
Affiliations: Saltire Software
Keywords:

In this paper, we use the symbolic geometry program Geometry Expressions to analyze three problems involving envelope curves. First we examine the envelopes of families of lines through points which are equally spaced on a pair of line segments. We use a combination of symbolic geometry and algebra to develop an expression for the area of the void in a popular string art figure consisting of 3 parabolas inscribed in a triangle. We use an envelope approach to reduce a popular calculus problem - that of finding the longest ladder which fits around an asymmetric corner – to an algebra problem which is readily solved using CAS. Finally we study the caustic curves generated by reflecting a point light source in a shiny cylinder. We analyze these both experimentally and theoretically, and focus on determining the parametric and Cartesian locations of the cusps. These examples illustrate how symbolic geometry technology can be used to make mathematics fun, accessible and challenging.

Abstract for 13115

Managerial Issues of Teaching Mathematics
Authors: Jozef Hvorecky

Affiliations: Vysoka skola manazmentu Bratislava, University of
Liverpool
Keywords:

Mathematics belongs among the least popular subjects. The reasons
are quite known and well described for example in [1]. For that
reason, we concentrate on methods which could improve its image
among general audience. Instead of talking about internal problems
of mathematics, our paper discusses the issue as a managerial
problem. We use an analogy: What has to be done if Teaching
Mathematics would be an enterprise with a similarly bad reputation?
Based on the parallel, we propose long-term solutions and later
exemplify them. As shown, the most of them requires substantial
changes in mathematicians' minds and in their approach to their
teaching methodologies.

Abstract for 13207
New Views at Teaching and Learning with CAS
Authors: Bernhard Kutzler
Affiliations: ACDCA - Austrian Center for Didactics of Computer
Algebra
Keywords:

Using powerful technology such as computer algebra systems for
teaching and learning mathematics and related subjects means an
enormous enrichment which, for many educators, in particular novices
and technophobes, at first glance appears complicated, sometimes
even threatening.
We offer several new views at how to involve technology, in
particular CAS, in the classroom, which are helpful in various ways,
such as for planning its proper use, for getting more educators
excited in using technology, for making teacher training more
efficient, …

Abstract for 13259
Making Mathematics Fun, Accessible, and Challenging using
Mathematica 6
Authors: Paul Abbott
Affiliations: School of Physics, University of Western Australia
Keywords:

The theme of this year's conference is "Making Mathematics Fun,
Accessible and Challenging through Technology". Version 6 of
Mathematica, released in May 2007, is instantly interactive,
allowing teachers and students to easily construct live interfaces
to illustrate and investigate mathematical concepts at all levels.
Over 1700 examples of these interactive capabilities, including a
number written by high school students, are freely available at the
Demonstrations Project website (http://demonstrations.wolfram.com).

Other new features of Version 6, relevant to this conference, include high-quality adaptive visualization of functions and load-on-demand data of mathematical properties such as graphs, knots, lattices, and polyhedra. In this talk I will demonstrate several of these new capabilities, showing how much fun one can have when the technology is high-level, robust, portable, and easy to use.

Abstract
The Internet and Critical Points in Calculus, Geometry, and Topology
Author: Tom Banchoff
Affiliation: Brown University
Internet-based courses in calculus, geometry, and the topology of surfaces make it possible for students and teachers to explore topics that start in calculus and continue to grow in subsequent courses. Starting with critical points of functions of one and two variables, we trace this theme through the Critical Point Theorem and the Gauss-Bonnet Theorem."

Abstract for 13426
Technology and Teaching Mathematics, an Indian perspective
Authors: Inder Kumar Rana
Affiliations: I. I. T. Bombay, India, ATCM, AMS
Keywords:

Topics: Implementation of Technology from K-12 Level, Assessment of Implementation of Technology in Education, Mathematics Teaching, Learning and Assessment using Technology
Abstract:
The talk will consist of:
(1) Indian Education System
Education system in India is "10 + 2 + 3" model. The Indian education system is very examination-oriented. As education is a state matter and there are in all there are 26 states. There is little scope for innovation and use of technology in regular teaching
(2) My perspective of teaching mathematics and role of technology.
In this part we will discuss a methodology of supplementing regular teaching to make the subject matter more lively and stimulating.
(3) My experiences of conducting math labs.
In this part we will discuss my personal experiences of conducting math lab sessions for middle school students (age 13-14) and for senior secondary students (age 16-17).
Part (2) and (3) of the talk will have multimedia presentations.
(4) Conclusions

Abstract for 13558
Experiencing the multiple dimensions of mathematics with dynamic 3D geometry environments:
Authors: Colette Laborde
Affiliations: University Joseph Fourier
Keywords:

Topics: Mathematics Education using Information & Communication Technology, Mathematics Teaching, Learning and Assessment using Technology

In this paper, we start from the distinction between two processes : iconic and non iconic visualization. Both are involved in solving problems in geometry. The non iconic visualization consists in breaking down an object into parts of same or lower dimension. This cognitive process is critical for solving problems in geometry as very often the reasoning consists in establishing relationships between elements of the figure. However this process is not spontaneous and must be learned. 3D geometry is the source of new problems regarding iconic and non iconic visualization. On the one hand, iconic visualization is not always reliable as it is in 2D geometry, on the other hand non iconic visualization is more complex since it deals with a larger number of kinds of objects, from dimension 0 to dimension 3. The paper examines how 3D dynamic geometry environments with direct manipulation and the tools they offer may enlarge the iconic visualization and assist the non iconic visualization. The example of Cabri3D is used to illustrate the analysis.

Abstract for 13831
Exploring the Place of Hand-Held Technology in Secondary Mathematics Education
Authors: Barry Kissane
Affiliations: Murdoch University
Keywords:

Topics: Implementation of Technology from K-12 Level, Mathematics Education using Information & Communication Technology, Technology and Curriculum Issues, Mathematics Teaching, Learning and Assessment using Technology, Applications using CASIO technologies
While sophisticated technology for mathematics is available and used in many educational settings, there are still many secondary school mathematics classrooms in many countries in which student access to such facilities is either very limited or non-existent, either at home or at school. This paper focuses on secondary mathematics education for students and teachers who are without reliable and regular access to computers or to the Internet. The place of hand-held technologies, including scientific calculators, graphics calculators and integrated devices will be considered. The computational support such devices offer to students is described and evaluated. Opportunities for new approaches to teaching and learning mathematics are described. The significance of hand-held technologies for aspects of the mathematics curriculum, its evolution and its assessment will be outlined and some issues associated with effective integration of technology into the secondary school curriculum are identified.

Abstract for 13828
How to motivate teachers to want to use technology
Authors: Douglas Butler
Affiliations: iCT Training Centre (Oundle School), UK

The TSM (Technology for Secondary Math) workshops have a fantastic reputation in the UK for motivating teachers to use computer-based technology effectively. The annual 3-day residential workshop concentrates on two areas: to become fluent in Word and Excel for mathematics, and then to make the best use of dynamic software in the classroom.

Abstract
Both Computer and Traditional Technology Are Inevitable for Mathematics Teaching:
Revisiting why we use technology
Author: Masami Isoda
Affiliation: Univeristy of Tsukuba, Japan

We use technology to improve mathematics education. The first part of this lecture, the logical inconsistencies for introducing technology come from the difference of society, curriculum and technology itself will be mentioned. Because inconsistencies logically existed, we should develop the judicious position of using technology. The judicious users will be teachers and students. The second part, I would illustrate the Japanese approach by focusing on teachers. The later half, I would addressed the importance of judicious using of technology if it is to be a necessity in enhancing students mathematical explorations and developing mental object in order to support their mathematization. The basic theories of mathematics education will be applied to explain this position. To illustrate the importance of both the traditional and computer technology, I would use the perspective drawing and mechanical motions as for the example.

Abstract for the Special Session
Connecting Dynamic Geometry Software with Computer Algebra System
Authors:
Thomas F. Banchoff, U.S.A.
Jen-chung Chuan, Taiwan
Jean-Marie Laborde, France
Phillip Todd, U.S.A.
Wei-Chi Yang, U.S.A.

This special session consists of five short presentations. Each author will demonstrate their examples to show why it is crucial to connect Dynamic Geometry (DG) with Computer Algebra System (CAS) in achieving the followings:
•   Making Mathematics more accessible to more students.
•   Motivate students to investigate more challenging problems.