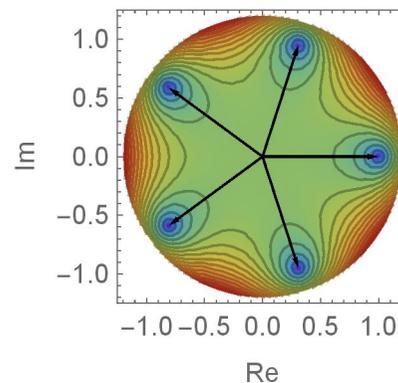


CADGME - 2016

Modeling approach in teaching Math students: experiences of our courses

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□ *Software*

To run the interactive version, download the Wolfram CDF Player:

<http://education.wolfram.com/cdf-player-download.html>

□ *Acknowledgment*

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□ *Keywords:*

Modeling approach, experimental mathematics, dynamic simulation, Wolfram Mathematica

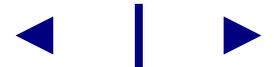
□ *Abstract*

On the previous CADGME conference, we spoke about the problems arising in teaching math courses for students in applied sciences. Now, it turns out, we need to speak about teaching applications to math students. Experimental arguments are accepted and even preferred in applied sciences, and such approach is also useful in

theoretical mathematics, but it is not easy to convince the students about the use of experimental and modeling approach.

Although the interdisciplinary and modeling approach became popular "keywords" in teaching mathematics students, the current practice is not as nice as we should think even in 2016. Deep theories are learned by the math students with hardly any applications. A new course "Mathematical model" given to freshman students try to help to resolve this problem.

In our talk, we will present the main idea, didactic goals, the curriculum and experiences of teaching models to our math students. We illustrate the talk with a lot of examples and dynamic demonstrations prepared in Wolfram Mathematica.



Outline

■ Introduction

- *Preliminary thoughts*
- *Science Students vs. Math Students*
- *On the modeling courses*

■ Examples of lecture presentations

- *Functions: formulas vs. measured data*
 - Functions
 - Parametric curves

□ *Discrete models*

- Linear difference equations, usage the properties of matrix powers

□ *Continuous models*

- Models in biology

□ *Functions of two variables*

- The meaning of the Hesse matrix

■ **Some lab work schemes**

- Functions given with data
- Path of motions in 2D
- Path of motions in 3D
- Functions of several variables

■ Student projects

- The owner's dog
- The neighbor's dog
- Euler method
- Taylor approximation
- Functions of two variables

More, helping the project development

- ***Experimental Studies in Population Dynamics, by A. Dénes, G. Röst, J. Karsai, 2015***
- ***Partial Differential Equations: Theory and numerical methods, Polner M., 2015***
- ***Symbolic Computation with Polynomials: Interpolating and Extremal Polynomials, Vajda R., 2015***
- ***Visual introduction to Bifurcations, Zs. Vizi, 2015***

Information

- ◆ www.model.u-szeged.hu

Books, teaching collections (selected)

Mathematical Models, lecture notes, 2016, J. Karsai

Experimental Studies in Population Dynamics, by A. Dénes, G. Röst, J. Karsai, 2015

Partial Differential Equations: Theory and numerical methods, Polner M., 2015

Symbolic Computation with Polynomials: Interpolating and Extremal Polynomials, Vajda R., 2015

Visual Introduction to Bifurcations, Vizi Zs., 2015

Interesting Mathematical Problems in Sciences and Everyday Life, 2011, edited by R. Vajda, J. Karsai

Math Lectures for Life Science Students, 2013, by J. Karsai

Impulzív jelenségek modelljei - Models of impulsive phenomena, TypoTeX, 2002, by J. Karsai

Numerikus módszerek: Elmélet, Feladatok, Kísérletek, 2011, by R. Vajda

Computer-aided study of mathematical models with *Mathematica*, by J.

Karsai, 1999 →...

Mathematical and visualization packages: Mathematica, by J. Karsai, 1999 →...

Computer-aided mathematical modeling, problems of final tests (2008 - →...),
by J. Karsai and R. Vajda

Computer Algebra (TFH Berlin), problems of final tests (2000 - →...), by J.
Karsai

Math for Pharmacy Students, problems of tests (1998 - →...), by J. Karsai

Theses

Applications of cellular automata in population dynamics, by É. Rácz, MSC, 2000

Territory-occupying populations: A computer-aided study, by I. Szimjanovszki, MSC, 2008

Computer-aided study of the motion of the pendulum, by A. Kovácsházi, BSC, 2010

Impulsive models in Pharmacy, by Á. Hulmán, MSC, 2010

Computer - Aided Modeling of Duopolies, by A. Kovácsházi, MSC, 2012

Application of fractional calculus in a biomechanical model, by N. Juhász, MSC, 2013

Computer-aided study of vaccination models, by Zs. Vizi, MSC, 2013

On a delay model of Cheyne-Stokes respiration: Computer-aided study, by E.

Bánhegyi, BSC, 2014

The effect of the reduction of the needle exchange program on the spread of HIV, by E. Bánhegyi, MSC, 2016

Thanks for your attention

