SIMIODE Newsletter April 2016

Volume II Number 2

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WELCOME TO SIMIODE AND OUR NEWSLETTER

SIMIODE - Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations is about teaching differential equations using modeling and technology upfront and throughout the learning process. Learn more at our dynamic website, www.simiode.org , where we offer a community in which colleagues can communicate, collaborate, publish, teach, explore, contribute, and engage.

The Newsletter will keep you informed about SIMIODE activities. Please give us a look and continue receiving news of SIMIODE in this manner. Contribute items of your own by sending them to Director@simiode.org. Thank you.
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REGISTERING IN SIMIODE

If you have not registered in SIMIODE please go to our Home Page and do so to benefit from the rich resources in the SIMIODE community.
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SOPHUS LIE ON DIFFERENTIAL EQUATIONS

Marius Sophus Lie was a Norwegian mathematician who lived in the second half of the 19th century. He gained his fame by applying group symmetries to study differential equations. This gave him prominence in the field of mathematics.

Of differential equations he said, "Among all of the mathematical disciplines the theory of differential equations is the most important . . . It furnishes the explanation of all those elementary manifestations of nature which involve time."

That says a great deal about the appeal and power of differential equations. Moreover, it provides good reason to teach and study differential equations in a modeling first approach that we use in SIMIODE.
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ANNOUNCING SIMIODE MINICOURSE AT MATHFEST 2016 - COLUMBUS OH USA

TITLE: Teaching Modeling First Differential Equations - Building Community in SIMIODE.

TIME and LOCATION:

Part 1: Thursday, August 4, 3:30 PM – 5:30 PM, Taft D

Part 2: Saturday, August 6, 1:00 PM – 3:00 PM, Taft D

DESCRIPTION: This minicourse permits participants to experience SIMIODE - Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations, an online (www.simiode.org) community of teachers and learners of differential equations who use modeling and technology throughout the learning process. Participants do modeling scenarios from the student perspective, discuss pedagogical and content issues that might arise in such teaching, and initiate the development of their own modeling scenario contributions to SIMIODE through partnering with other participants during and after the minicourse. The minicourse is appropriate for all interested in teaching differential equations in a modeling first approach.

LEADERS: Therese Shelton, Southwestern University and Brian Winkel, SIMIODE

Our leadership team will be joined by Rosemary Farley and Patrice Tiffany, Manhattan College.

Complete details and registration information will be in the spring copy of MAA's *FOCUS* magazine. Consider joining us and put the dates in your calendar.

LOOKING AHEAD TO SIMIODE MINICOURSE AT JMM 2017 IN ATLANTA GA USA

The title of the minicourse is, "Teaching Modeling-First Differential Equations – Technology and Complete End Game Efforts." The team leading this effort will be Rosemary Farley, Manhattan College; Therese Shelton, Southwestern College; Patrice Tiffany, Manhattan College; Jon Paynter, US Military Academy; and Brian Winkel, SIMIODE.

We will offer experiences for building and teaching mathematical models with differential equations: epidemic model of school infirmary, Torricelli's Law, fishery management effort, post-operative retinal fluid dissipation, fair stadium design, sublimation of carbon dioxide, chemical kinetics, ant tunnel building, spread of oil slick, pursuit efforts, pharmacokinetics of LSD and paracetamol, shuttlecock fall, and lake algae. We will discuss the role technology plays in the end game modeling efforts of parameter estimation, non-linear regression analysis, and model comparison. Through hands-on small group learning, faculty will experience the use of modeling and technology to teach differential equations. We, of course, plan to use SIMIODE - Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations, an online (www.simiode.org) community of teachers.

Look for more details in Fall 2016 in MAA literature and website.

DIFFERENT TECHNOLOGIES IN USE

When asked to submit a homework assignment using WORD and equations with proper form in a class taught by Sania Qureshi, an Assistant Professor at Basic Sciences and Related Studies, Mehran University of Engineering and Technology, Jamshoro, Sindh PAKISTAN, one student offered a camera image of the hand written three pages for the statement and solution of a modeling problem with differential equations. The student suggested that doing the homework in WORD and getting the equations correct "takes much time."

When some professors teach such materials they have students use Mathematica or Maple and ask that they write up their narrative AND their mathematics in an appropriate file. Some professors request that their students use LaTeX to write materials for submission in their courses. Thus we see there are many ways to use technology.

As an example of the options we offer the summary posting, imagery, and Mathematica material here.

SIMIODE CHANNEL AT YOUTUBE

SIMIODE has a channel at YouTube SIMIODE YouTube Channel. In addition to an introductory overview, a video of what SIMIODE is and can be, there are several videos related to Torricelli's law in which students can collect their own data from a real physical event, model the phenomenon, estimate parameters, and confirm their analysis with comparisons of plots of final model and data. One video is for a right circular column of water in which the water is draining from the cylinder while a digital clock offers time to the thousandth of a second in the background and the height can be seen to the nearest millimeter. Here is an example at Falling Column of Water in Cylinder. Another is of right circular cone of water in which the water is draining from the cone while a digital clock offers time to the thousandth of a second in the background and the height can be seen to the nearest millimeter.

STREAMING OF VIDEOS IN SIMIODE

In the current version of the HUBZero platform for SIMIODE we can now stream all videos offered by colleagues who post them. This means individuals who cannot gain access to YouTube can get access to our videos directly at www.simiode.org. Moreover, now videos will be positioned at the appropriate place in support of the material offered. Here is an example Cannister Falling in Water associated with the modeling scenario 3-70-S-FallingInWater. These videos have been effective substitutes for real lab data acquisitions, indeed, they are videos of real lab data acquisitions. We will continue to also post videos on our SIMIODE YouTube Channel.

INTRODUCTION TO SECOND ORDER DIFFERENTIAL EQUATIONS MODELING

Second Order Introduction is a 28 page introduction to solution strategies and many models in which to use these strategies. This Modeling Scenario also makes use of technology, Mathematica. However, the Teacher Version permits alteration to the computer algebra of choice.

We quote from the Abstract and the Teacher COMMENTS:

Abstract: We outline the solution strategies involved in solving second order, linear, constant coefficient ordinary differential equations, both homogeneous and nonhomogeneous and offer many application and modeling activities.

COMMENTS (to teacher): We have assembled all the techniques, theory, and machinery for solving second order, linear, constant coefficient, homogeneous and nonhomogeneous differential equations. We have suggested forms of the solution and lead into use of the characteristic equation.

Further, we have offered a number of settings in which to try out our newly acquired knowledge. We suggest the teacher require students to read (before class) or in groups selected sections of technique or lecture on them with this literature in support of learning and then assign applications which are appropriate for the students.

While the commands offered in this document are in Mathematica code the concepts and approaches can be carried out in any computer algebra system with symbolic manipulation, such as Maple.

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NEW MODELING SCENARIOS AND A TEXT NARRATIVE AT SIMIODE

A good number of Modeling Scenarios and one Text Narrative have worked their way through the referee and editorial process are now available (more on the way!) Here are some which might interest you.

Combating Ebola Epidemic From the abstract, "This project offers students a chance to make a policy recommendation (funding decision) based on the analysis of a nonlinear system of differential equations (disease model). The scenario is taken from the fall of 2014 when the Ebola outbreak in West Africa had killed thousands, and the United States military was deploying a variety of resources to help the affected countries. This mission, Operation United Assistance, included a mandate for the military headquarters to advise the governments of West Africa in their efforts to combat the Ebola epidemic."

Water Falling In a Cone From the abstract, "We offer an opportunity to model the height of a falling body of water in a right circular cone (funnel) and to estimate an appropriate parameter based on data collected from a video of the experiment found on YouTube. This is an application of Torricelli's Law."

Modeling Improvised Explosive Blasts From the abstract, "These three exercises offer students a chance to solidify their understanding of modeling with second order ordinary differential equations (ODEs), how they might incorporate a spring-mass system into a larger model, and how they can use the model to help determine the results of a dynamical system. Our emphasis throughout is on helping students transform a real-world scenario into a model. The scenario for all of the exercises comes from the authors' experiences deployed in the army, and real concerns about terrorist affiliated organizations in the Sinai Peninsula in 2015."

Laplace Transform Birth From the abstract, "We present a way of introducing the Laplace Transform as the continuous analogue of a power series expression of a function."

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INDIVIDUAL MEMBER ACTIVITIES

Chris Mccarthy, a mathematics faculty member at Borough of Manhattan Community College, CUNY, in New York City NY, has found some interesting modeling scenario materials in his collaborative work with students and chemists at his school. We look forward to seeing them at SIMIODE. Chris is studying the adsorption of heavy metals in tea leaves. He is working with chemists at his school and he has engaged students in the research. Last Spring his students presented a fine poster session on their work. What Chris is doing illustrates the richness of engaging in modeling, namely collaboration with colleagues and engaging students in research and presentation. Several of these students are new to America and this effort helps them learn to communicate their technical ideas and to improve their English. Congratulations Chris!

Our February 2016, Volume II, Number 1 Newsletter went out late, VERY late - early April 2016! In the issue we offered readers an opportunity to win a way cool SIMIODE T-Shirt by answering trivia questions about SIMIODE's web site. Within hours of sending out the newsletter we received correct answers from Vanessa Rivera Quiñones, a doctoral student at the Department of Mathematics, University of Illinois at Urbana-Champaign IL, where she is pursuing studies in applications of differential equations. She says, "I am interested in tackling problems in biology and the social sciences." May she wear her SIMIODE T-Shirt proudly. Congratulations Vanessa! The contest is still open so go to the SIMIODE February 2016, Volume II, Number 1 Newsletter and get to work on these questions, submit your answers, and get YOUR FREE SIMIODE T-Shirt.

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WORDS OF ENCOURAGEMENT FROM THE DIRECTOR

SIMIODE is a community which is alive, vibrant, and rich in resources and individual talents to assist colleagues who wish to teach differential equations using modeling to motivate students.

There are a number of ways you can add to the community:

Contribute materials -- You can do this at Resources: New. There you will find types of materials and instructions on how to contribute and begin the process leading to publication in SIMIODE.

Register to referee and review submitted materials. -- Good scholarship merits attention and our double-blind, peer-referee system affords quality reviews of submitted materials. Please, visit our Manuscript Management system and register as a referee.

Post slides from your presentations or talks. -- When you give a talk locally or beyond you can post your slides, details of the talk or meeting, and comments at Resources: Presentations. Now that you have spread the word beyond the SIMIODE community bring it back home for your fellow SIMIODE members to see.

As always please let us hear from you with your concerns, your news, and your activities. Contact us at Director@simiode.org.