

## Volume IV Number 3

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### WELCOME TO SIMIODE AND OUR NEWSLETTER

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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](http://www.simiode.org). SIMIODE is now entering its fifth year as a community and its fourth year in publishing this newsletter.

SIMIODE is a 501(c)3 nonprofit organization, based in Cornwall, New York in the United States. Contact: [Director@SIMIODE.org](mailto:Director@SIMIODE.org).

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### NATIONAL SCIENCE FOUNDATION AWARDS SIMIODE THREE YEAR \$450,000 GRANT

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The National Science Foundation has awarded SIMIODE a three year grant for \$450,000 to promote the use of modeling in motivating and teaching differential equations in high schools and undergraduate institutions. We are pleased at this vote of confidence in SIMIODE as reflected in National Science Foundation funding and we will use the funds wisely to spread the word of using modeling in teaching differential equations.



NSF Funds will support [Developer Workshops](#) and [Practitioner Workshops](#) each summer in 2018, 2019, and 2020. SIMIODE leadership will be supported for travel to national and regional meetings to organize contributed paper sessions, lead minicourses and workshops, and develop community through personal interactions. Further, funds will be used to enrich, enhance, expand, and enable new programs of the [SIMIODE web community](#) on line and to assess and evaluate the effectiveness of the workshops and the overall SIMIODE program to help faculty to use modeling in teaching differential equations coursework.

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### NSF SIMIODE DEVELOPER WORKSHOPS AND PRACTITIONER WORKSHOPS

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SIMIODE will conduct NSF sponsored [SIMIODE Developer Workshop](#) (DEMARC -- [Differential Equations Model And Resource Creators](#)) and [SIMIODE Practitioner Workshop](#) (MINDE -- [Model INstructors in Differential Equations](#)) in the summers of 2018, 2019, 2020, and beyond.

The Developer Workshop will host 20 faculty who will produce teaching materials - Modeling Scenarios and Technique Narratives. The 2018 SIMIODE Developer Workshop will be held at Manhattan College, New York NY, from 15 - 21 July 2018.

SIMIODE 2018 Workshops are now full. However, SIMIODE will offer (with NSF support) comparable workshops during the summers of 2019 (George Fox University, Newberg OR USA) and 2020 (Virginia Wesleyan University, Virginia Beach VA USA). We will announce these in due course.

The Practitioner Workshop will afford 20 faculty the opportunity to learn about teaching in a modeling first differential equations approach through their own engagement as teacher to fellow workshop personnel using SIMIODE teaching materials; mentored discussions on how to incorporate modeling; collaborative efforts to build scaffolded and more intensive modeling efforts in individual coursework; support for authoring their own materials through SIMIODE's double-blind, peer-reviewed online publication system; presentation on how to prepare article for publication in scholarly journals; and ongoing conversations during the academic year in support of these new teaching approaches.

See [DEMARC](#) - NSF SIMIODE Developer Workshop and [MINDE](#) - NSF SIMIODE

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## SCUDEM FOR YOU AND YOUR STUDENTS

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SIMIODE sponsors a modeling competition specific to the pivotal STEM course, differential equations. We call it [Student Competition Using Differential Equations Modeling \(SCUDEM\)](#). After our very successful inaugural SCUDEM on 14 October 2017 at Mount Saint Mary College, Newburgh NY USA, we offered [SCUDEM II 2018](#) at 40 sites to over 400 students on 21 April 2018. We report complete results of [SCUDEM II 2018](#).

Want to learn more about SCUDEM? To share the joy in engaging students in modeling with differential equations in a supportive, friendly, and fun competition? Join us at SCUDEM MeetUp at MathFest, Friday, 3 August 2018, from 4:30-6:30 PM in the Silver Room, Tower Building, Sheraton Downtown Denver Hotel. This will be a chance to meet colleagues who have hosted and/or participated in SCUDEM and who are considering participating in SCUDEM III 2018.

We offer a [SCUDEM I 2017 video](#) and a [SCUDEM II 2018 video](#) in which students and faculty share their enthusiasm for using modeling in solving solve real problems to learn differential equations. Student interviews are very, we mean VERY, convincing as to the value of this modeling competition in their learning and growth in applying the mathematics they are learning.

At the [SCUDEM I 2017 site](#) and [SCUDEM II 2018 site](#) we offer complete results including the statement of the posed problems, the additional issues offered on Competition Saturday, results with all student submissions, award information, a way cool [SCUDEM I 2017 video](#) and [SCUDEM II 2018 video](#), a [PowerPoint overview](#) of the event, [SCUDEM I 2017 MathBowl](#) and [SCUDEM II 2018 MathBowl](#) fun competitions. Try it. You will enjoy it! You can find answers in the Teachers Group Resources at SIMIODE.

We will be announcing SCUDEM III 2018, 27 October 2018, opens with registration from 1 August through 5 October 2018. We [invite schools to be local hosts](#) for SCUDEM III 2018. Hosting schools will receive a stipend (one half registration fees) in support of their contribution. This competition is for three member teams of students. SCUDEM takes place over a week-long period which will begin with teams selecting one of three modeling problems on Friday, 19 October 2018, at each team's individual home campus, and culminates on Competition Saturday, 27 October 2018, at 9:00 AM at a nearby regional host site in the United States and beyond.

Complete information can be found at [SCUDEM](#).

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## FACEBOOK GROUP - SCUDEM MATHEMATICAL COMMUNITY

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We invite all to join the [Facebook Group - SCUDEM Mathematical Community](#).

SIMIODE takes the challenge of bolstering mathematical inquiry, reasoning, and application seriously. We encourage group members to share compelling assignments, questions, problem ideas, and modeling scenarios using differential equations with the group. We are interested in ones they have worked on or ones they think would be interesting and need more efforts. All are welcome. So please join us as we continue to grow and share the incredible stories of students and faculty across the world who enjoy exciting applications of differential equations.

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## SIMIODE IS A 501(C)(3) TAX EXEMPT ORGANIZATION - PLEASE SUPPORT US

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SIMIODE is a 501(c)(3) tax exempt organization and can accept tax deductible contributions from individuals, corporations, and foundations.

Think of your differential equations course and how applications and modeling would have been so beneficial to motivate you and your fellow students. SIMIODE is your chance to support this approach for students now. You can see students value this approach in our [SCUDEM 2017 video](#). Join us and contribute your support, financially and intellectually.

As a mathematics education organization we are open to receiving public support. In fact, we need this support to exist, so please contribute. You can contribute financial support for SIMIODE in whatever amount you feel appropriate at [Donate](#). See our [Mission Statement](#) for reasons why you should support SIMIODE. All contributions are tax-deductible. For ANY contribution we will send you a letter of appreciation, acknowledging your contribution, for tax purposes. Please provide your email for this letter. Thank you.

You may confirm our NonProfit status at the official listing of SIMIODE in the [IRS Organization List of NonProfit Organizations](#).

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## RECENT PUBLICATIONS OF MODELING SCENARIS IN SIMIODE.

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Modeling cancer tumors is the focus of a new Modeling Scenario [1-081-TumorGrowth](#) by Randy Boucher and Ryan Miller of the United States Military Academy, West Point NY USA. Students transform, solve, and interpret a tumor growth scenario using non-linear differential equation models. Two population growth models (Gompertz and logistic) are applied to model tumor growth. Students use technology to solve the Gompertz model and answer a series of questions designed to further their understanding of growth models and to refine their ability to analyze and compare mathematical models.

Michael Karls shares a Modeling Scenario on beer bubbles [6-070-S-BeerBubbles](#) while Kurt

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## WHAT ARE YOU WAITING FOR? PUBLISH IN SIMIODE.

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If you are teaching differential equations of some sort you have probably written and assigned projects. Consider publishing your materials online using our peer reviewed, double blind referee system.

You can see how to submit your materials [here](#). What you do is important to your students, but it is also worthy of sharing with colleagues and their students. Step up and write up your projects for SIMIODE. You will have an online refereed publication at SIMIODE. You will be pleased to know others are using your ideas, building on your success, and enjoying what you share with your students. So, what are you waiting for? Just do it!

One purpose of SIMIODE is to offer colleagues solid, refereed teaching material on which they can base a modeling first course in differential equations. Thus publishing new ideas and activities for students is a main goal of SIMIODE.

However, it is reasonable to ask yourself, "Why should I prepare, submit, and publish in SIMIODE?" [Here](#) we give you many good reasons to publish in SIMIODE. Check them out and see that many fit you. Then join us by sending us your efforts.

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## PUBLISHING YOUR STUDENTS' PROJECTS

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As spring semester draws to a close consider encouraging your students to write up their differential equations course projects as a Modeling Scenario for other students. Learning how to turn an investigation into a pedagogical opportunity for fellow students will be a great learning experience.

Encourage and enable your students to submit these excellent projects for publication in SIMIODE. You can see how to submit materials [here](#).

We have a place for publishing completed student projects so others can see the work of your best and finest. Faculty can see what is possible, and perhaps use these ideas to design projects of their own. We call these [Potential Scenarios](#).

Also your students can submit their project when converted to teaching material to our [Manuscript Management](#) site for refereeing, editing, and acceptance. They can also submit supplemental materials, e.g., video, spreadsheet, data sets, computer algebra files, posters, PowerPoint slides, extra pdf files.

We believe quality student work is worthy of display, of sharing, and of praise. Do this for your students. Help them publish their good work at SIMIODE.

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## COMMENTS HELP CREATE COMMUNITY AT SIMIODE

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For each posting in SIMIODE community members have the option to post COMMENTS. This is strongly encouraged as it will build conversations which will connect colleagues, improve material, and build community. Any posted Comment will be emailed to the author of that resource and conversations can then begin.

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## CALL FOR TECHNIQUE NARRATIVES FOR SIMIODE

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We publish more and more Modeling Scenarios all the time. Indeed, these are the core of support material for colleagues planning to do more modeling in support of learning differential equations.

It is also important to offer colleagues and their students what we call Technique Narrative activities. These are closer to the traditional material of solution strategies and methods offered in differential equations courses and may help faculty in a more comfortable transition to using modeling in their teaching. SIMIODE offers a small but growing list of [Technique Narratives](#). As with Modeling Scenarios, we have a Student Version in which the STATEMENT of the problem is offered with supporting materials and we have the Teacher Version in which COMMENTS are offered to assist in planning, teaching, and carrying out the modeling activity.

A good example of a Technique Narrative is found in [1-002-S-Text-IntegratingFactor](#). Here the solution method of Integrating Factor is illustrated and exercises are placed in the context of science and engineering applications so the student can see not only the technique, but the worth of using the technique in context.

All Technique Narratives are FREE, downloadable, and customizable under the most generous Creative Commons license. [Visit here](#) to see them all. The list is small, too small, so we request that you share your approaches to solution methods through writing them up for publication, just as you would a [Modeling Scenario](#). They are fully searchable by topics and area of interest to you.

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## SIMIODE EVENTS AT MATHFEST 2018 IN DENVER CO USA - 1 - 4 AUGUST 2018

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SIMIODE is sponsoring a **Minicourse: Initiating, Designing, Building, and Using Modeling Scenarios for Teaching Differential Equations**, organized by Brian Winkel, SIMIODE, Cornwall NY; Eric Sullivan, Carroll College, Helena MT; Lisa Driskell, Colorado

Mesa University, Grand Junction CO; and Audrey Malagon, Virginia Wesleyan University, Virginia Beach VA. Details will appear in Spring MAA FOCUS issue.

Description: This minicourse offers experienced guidance and hundreds of rich sources for initiating, designing, and building teaching materials for teaching differential equations using mathematical models from a wide variety of cognate disciplines. We offer this minicourse in support of colleagues who wish to create teaching materials for teaching differential equations through modeling. The leadership team of accomplished authors will discuss how they prepare and produce modeling scenarios and then help participants focus on projects of their own creation. We will share many sources for constructing teaching materials, point to immediate possibilities available to participants, and help them gain confidence in their ability to compose their own lessons. Through active, hands-on, small group work participating faculty will experience using modeling to teach differential equations from day one as but one example of the kind of material they can produce.

To apply for this (or other) Minicourse go to [MAA MathFest Minicourse](#) page.

SIMIODE is also running a **Contributed Paper Session: Modeling-Based Teaching and Learning in Differential Equations**, organized by Brian Winkel, SIMIODE, Cornwall NY; Lisa Driskell, Colorado Mesa University, Grand Junction CO; and Audrey Malagon, Virginia Wesleyan University, Virginia Beach VA. Details will appear in Spring MAA FOCUS issue.

Description: This session features talks centered around modeling-based teaching and learning in differential equations courses. Presentations may include descriptions of using modeling-based scenarios developed for these courses as well as shared experiences of using modeling in a course, from a one-time project to redesigning an entire course. We welcome speakers who are just beginning to use this method along with those with more experience. We are particularly interested in talks which feature real data (either collected or taken from the literature) and a full modeling process for students, i.e. stating assumptions, making identifications, creating a differential equation model, developing solution strategies, performing parameter estimations, rendering model validation, iterating this process, and communicating the results. Some evidence of the success of individual approaches should be offered.

Want to learn more about SCUDEM? To share the joy in engaging students in modeling with differential equations in a supportive, friendly, and fun competition? Join us at SCUDEM MeetUp at MathFest, Friday, 3 August 2018, from 4:30-6:30 PM in the Silver Room, Tower Building, Sheraton Downtown Denver Hotel. This will be a chance to meet colleagues who have hosted and/or participated in SCUDEM and who are considering participating in SCUDEM III 2018.

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## LOOK FOR CALL FOR PAPERS ON MODELING COMPETITIONS AT JMM 2019

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COMAP sponsored Mathematical Contest in Modeling (MCM), Interdisciplinary Contest in Modeling (ICM), and High School Mathematical Contest in Modeling (HiMCM), and SIMIODE sponsored Student Competition Using Differential Equations Modeling (SCUDEM) are team competitions in which students apply the mathematics they know to solve a real world problem. Students routinely report learning more in this 4-day period than any other period during college, and find it one of the most rewarding experiences of their undergraduate careers. Students point to this experience in interviews as an example of working in a team environment, meeting a deadline, and as evidence of their problem-solving ability. The value of participating is worth much more than the four days of work, making this an impactful experience for faculty advisors as well.

This MAA Contributed Paper Session is aimed at faculty who wish to begin advising teams and for current advisors to share strategies for student success. We invite presentations focused on building and supporting student teams, developing mentor relationships for faculty, and presentations elaborating the judging process in order to help advisors better prepare student teams. We especially encourage student teams who have achieved a "Meritorious" or higher rating to report on their contest experience.

The publication of this Call for Papers will appear in MAA's *FOCUS* and *Notices of the AMS*.  
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## FREE ONLINE DIFFERENTIAL EQUATIONS TEXTS

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We offer annotated listings of FREE online differential equations texts. This is one of the more popular sections when colleagues visit our site. There are over two dozen such texts. Colleagues have shared their materials in complete text form, often with traditional course structure, as well as rich sets of resources from which to teach. Most texts offered cover the basics of technique and offer exercises. Many offer modeling applications. Your students will appreciate a FREE text and you might enjoy the fresh approaches taken in such presentations. Try it!

Ideally we believe one could save students lots of money by using a FREE online text along with SIMIODE Modeling Scenarios. Make the move for your students and enjoy the excitement of using modeling to motivate learning in your differential equations course.  
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## SOURCES FOR YOUR OWN MODELING SCENARIOS

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SIMIODE offers potential modeling scenario ideas. There are hundreds of these! These are materials, thoughts, pointers, summaries, articles, etc. to encourage and support your modeling scenario ideas. You must be registered and signed in to view these resources. Consider these ideas and use them to design your own modeling scenarios for your students and then publish this material in SIMIODE.

Of course, you can publish your own source materials, perhaps ideas you have not been able to get to, but want to or wish to engage with others in producing a Modeling Scenario. Just upload them for all to see. Use the "Start a new Potential Scenario Idea" button and contribute.

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## SEVERAL WORTHWHILE PROJECT EFFORTS TO CONSIDER

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[Inquiry-Oriented Differential Equations \(IODE\)](#) offers a first course in differential equations focused on understanding of the big ideas in first order, second order, nonlinear, and systems of differential equations. The course is designed as a full semester course and topics covered include solving ODEs; numerical, analytic and graphical solution methods; solutions and spaces of solutions; linear systems; linearization; qualitative analysis of both ODEs and linear systems of ODEs; structures of solution spaces. The term inquiry includes the following three principles: deep engagement in mathematics, peer-to-peer interaction, instructor interest in and use of student thinking. At this site you will find student materials, teacher materials, links to tools/technology, relevant projects, and publications, as well as, contact information for the IODE Team.

The [CODEE Journal](#) is a peer-reviewed, open-access publication, distributed by the CODEE (Community of Ordinary Differential Equations Educators) and published by the Claremont Colleges Library, for original materials that promote the teaching and learning of ordinary differential equations.

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The [Consortium for Mathematics and Its Applications \(COMAP\)](#) is a source for all levels grade school high school. and higher education of modeling materials - books, modules, videos, and several [international modeling competitions](#) for high school and undergraduate students.

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## WORDS FROM THE DIRECTOR

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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 learn more about this at our [Author Information](#) section and get even more details once you have signed into SIMIODE. 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 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.

**When you attend a talk** -- on an application of differential equations encourage the presenter to consider sharing these ideas with the SIMIODE community. Encouragement helps young faculty expand their reach.

As always please let us hear from you with your concerns, your news, and your activities. Contact us at [Director@SIMIODE.org](mailto:Director@SIMIODE.org).

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