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SIMIODE & SCUDEM

SGCI

For information about the SIMIODE resources or the SCUDEM challenges visit https://www.simiode.org/
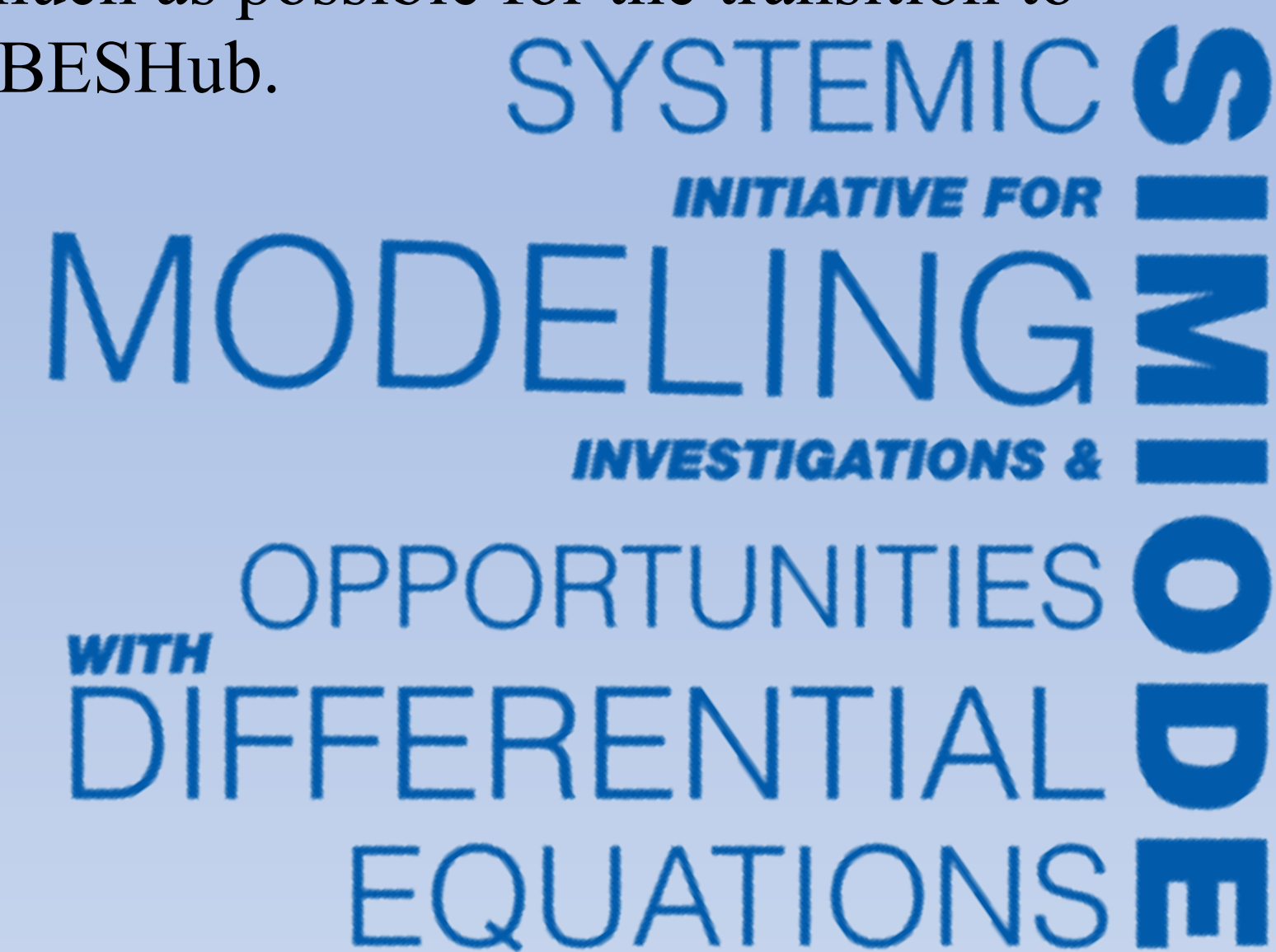
ABSTRACT

Systematic Initiative for Modeling Investigations & Opportunities with Differential Equations (SIMIODE) is an open education Community of Practice that provides web-based traditional text materials and modeling scenarios as an introduction and motivator for the study of differential equations. SIMIODE is for teachers and students. SIMIODE Challenge Using Differential Equations (SCUDEM) is an annual event held for undergraduates in which teams of 3 students engage in a modeling challenge of diverse problems and present their results virtually for judging and feedback. SIMIODE is funded by National Science Foundation (NSF) and is partnered with Science Gateway Community Institute (SGCI). In the summer of 2020, SGCI funded and provided SIMIODE/SCUDEM with interns that were tasked with projects to develop and enhance future directions of SIMIODE and SCUDEM. The overarching goal was to not only provide student perspectives of SIMIODE's resources and SCUDEM, but to also organize and better structure the SIMIODE platform for a transition of the SIMIODE website to a HUBZero community at QUBESHub. QUBESHub is a partner of SGCI and is a community for math and biology educators who share resources and methods for preparing students to use quantitative approaches to tackle problems. The overall user experience and structure of the SIMIODE website will be enhanced by this transition. This poster explains each project the interns engaged in, such as; to prepare and contribute to the SIMIODE resources, prepare for the next SCUDEM experience, and prepare as much as possible for the transition to QUBESHub.

SYSTEMIC INITIATIVE FOR MODELING INVESTIGATIONS & OPPORTUNITIES WITH DIFFERENTIAL EQUATIONS

Projects

SCUDEM V

SCUDEM V 2020 is a differential equations modeling opportunity for students, in high school or undergraduate college, to engage in modeling one of three given real-world problems. Teams produce a 10-minute video presentation of their model which they upload in private mode to YouTube for judging. Structuring and editing the SIMIODE web-page for SCUDEM V was the main task for the summer interns. As a by-product to working on and laying out SCUDEM V, the interns sought to enhance the student experience, which was achieved by providing a modeling guide for the students and coaches to reference while participating in SCUDEM V.
https://www.simiode.org/scudem

Differential Equations Textbook

SIMIODE will offer an online introductory differential equations (DE) textbook that not only has traditional methods supporting the teaching of what a differential equation is and solving techniques, but untraditional topics essential to modeling such as dimensional analysis, parameter estimation, and coding resources. But more uniquely, SIMIODE is hosting this textbook on the website because the textbook will teach differential equations in an unconventional approach from a modeling perspective first and throughout using the SIMIODE resources - differential equations in context. The summer interns have provided feedback and student perspective to the text for an overall better learning tool for students of the online DE text.

Tagging of Resources

There are more than 1000 resources on the SIMIODE website. Resources are user-submitted pieces of content that range from video presentations to publications to simulation tools involving differential equations. The types of content are articles and publications, free online texts, modeling scenarios, presentations, past SCUDEM submissions, sample syllabi and course reflections, technique narratives, and the like. When merging all this data to the QUBESHub platform, to organize the modeling scenarios, tags of their subjects or mathematical concepts were added to categorize them. For example, tags such as "ordinary differential equations" and "integrating factor" could be useful tags that help teachers find great modeling scenarios for their course and help students find modeling scenarios on material they may have been working on recently. However, tags such as "guitar" or "drug" can direct both students and teachers toward a modeling scenario that appeals to their interests.
https://simiode.org/resources/modelingscenarios
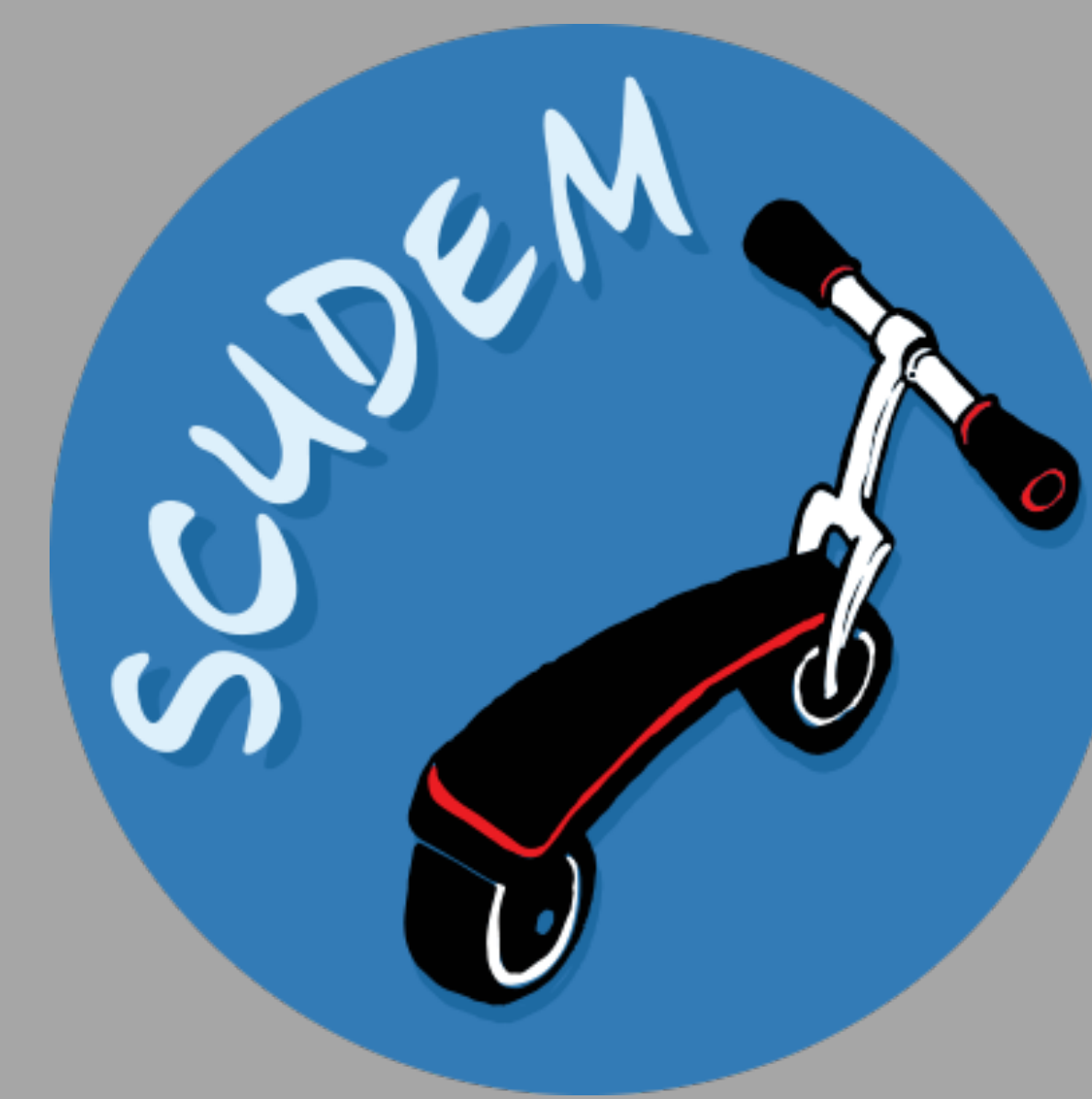
Social Media Outreach

Incorporating more frequent social media posts and structure to cause gravitation to the SIMIODE website has also been an ongoing task during this project. This summer, SIMIODE has expanded to other platforms than only Facebook, such as Instagram, in hopes of reaching broader communities and more students to gain interest in SCUDEM. Also, this project has generated a concern for how students can gain information and ask general questions while SCUDEM is underway, so the interns have suggested a solution to this was to develop a helpdesk available for students. Moreover, future directions toward scheduled posting apps are now on SIMIODE's radar.

Adding New Resources

More resources have been added to SCUDEM and SIMIODE. The interns suggested a resource that can help students and coaches guide the participants of SCUDEM. Therefore, the interns developed a modeling cycle guide that generally walks teams through good modeling practices that students can check while developing their model. Or coaches can walk their teams through to help the students learn important aspects of a strong model. Moreover, how to use Overleaf for a LaTeX presentation of their model and links to resources that help students code their model in Maple, MATLAB, Mathematica, and the like, have been added.
https://www.simiode.org/resources/7978
https://www.simiode.org/resources/7825
https://www.simiode.org/resources/7982

BACKGROUND OF WORKFORCE

Brian Winkel earned his PhD from Indiana University in Ring Theory in 1971. While teaching in his first position (Albion College, Albion MI USA) he developed an interest in applications of mathematics to biology and while teaching in an engineering setting (Rose-Hulman Institute of Technology, IN USA, United States Air Force Academy, CO USA, and United States Military Academy, West Point NY USA) he developed an interest in engineering applications of mathematics. Along the way he founded and edited three journals *Cryptologia* (1977 - Present), *Collegiate Microcomputer* (1982-1993), and *PRIMUS* (1990 - Present). Currently, Brian is a Co-PI of a National Science Foundation DUE-IUSE grant in support of SIMIODE Community of Practice, web space, workshops, and resource development and promotion.

Anthony Stefan earned his BS in Mathematics from Florida Southern College, Lakeland FL, and participated in SCUDEM III in Spring 2018 as an undergraduate student where his team modeled predator-prey relations using differential equations. Since then he has participated as both a judge and as a coach in SCUDEM challenges and published a paper on his SCUDEM experience. Currently, he is an applied mathematics graduate student at Florida Institute of Technology, Melbourne FL.

William Clark is an undergraduate at Dixie State University, St. George UT, pursuing a BS in mathematics. He participated in SCUDEM Lite in Spring 2020 where he modeled the outbreak of Covid-19 and how social distancing can affect the death outcome of a worst case scenario in Washington County, UT. Currently, he is a senior at Dixie State University and wants to participate in more SCUDEM challenges. William plans to pursue a PhD in mathematics.

ACKNOWLEDGEMENTS

CONCLUSION

There has been, without a doubt, a significant intern contribution to the structure, material, and outreach of both SIMIODE and SCUDEM for their users, either student or teacher. This internship project brought in the student perspective of experienced individuals of SIMIODE and SCUDEM's components to brainstorm abstractly how the organization can improve, grow, and offer a better overall educational experience. This project has also organized SIMIODE's resources on the website for a smoother transition into QUBESHub.