

News and Offerings of CODEE

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Cornell University
SIMIODE EXPO 2023



codee.org

**CODEE: Community of Ordinary
Differential Equations Educators**

CODEE Brief History

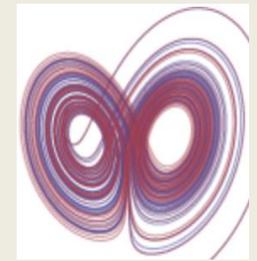


Before there was the internet as we know it today, it was a *very* different time. Thirty-one years ago, in **1992**, Bob Borrelli and Courtney Coleman, of Harvey Mudd College in Claremont, CA launched CODEE (Consortium for Differential Equations Experiments).

-Harvey Mudd College,
-Cornell University,
-Rensselaer Polytechnic Institute,
-Washington State University,
-St. Olaf College,
-West Valley Community College,
-Stetson University

With the first of three NSF grants they brought together colleagues, from seven diverse institutions, who were harnessing the recent availability of computer graphics to make the study of differential equations so much more powerful.

CODEE: First NSF Grant



Over 4 years each of the seven institutions held a weeklong summer workshop at their schools, each for 30 colleagues from all over the United States.

Also, for many years we ran sessions and workshops at JMM and other meetings, and produced a newsletter (on paper!), to spread the news of this revolution and help colleagues (and their institutions) overcome inertia and adjust to accessing this new power for solving differential equations – to be able to see *behaviors*, even for the majority of differential equations that do not *have* analytic solutions (in terms of elementary functions). As *you* (but not everyone) already knows, this enormously helps studying real world systems.

CODEE : Second NSF Grant



With a subsequent NSF grant, CODEE members worked together and created a software package, *ODE Architect*, to take advantage of the computer graphics revolution.

ODE Architect was published by Wiley & Sons, and won an amazing award from Forbes Magazine as one of the “nine best software projects on the planet” in **1998** (and the *only* one in mathematics).



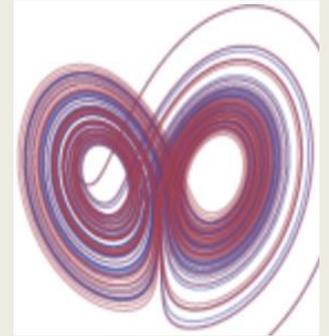
But -- Software doesn't *last* !



Unfortunately, as operating systems evolved, many early graphics software packages specifically for differential equations, including ***ODE Architect***, have become obsolete. We are currently updating our Resources page on the CODEE website (codee.org), particularly the Software Resources section. We surveyed our Editorial Board asking what software *they* used in *their* ODE courses.

More than half the respondents use **Maple**, **Mathematica**, or **Matlab**, as their primary course resource (because their schools subscribe and their students become familiar with it in other courses). Many dedicated Differential Equations packages were also listed – we mention a few. Favorites that are written in Java may need help to run.

We have learned of a fix that *does* allow Java applets



Some favorite applications (next slides) are written in Java, but can still be run using a

CheerpJ Applet Runner to *Chrome*.

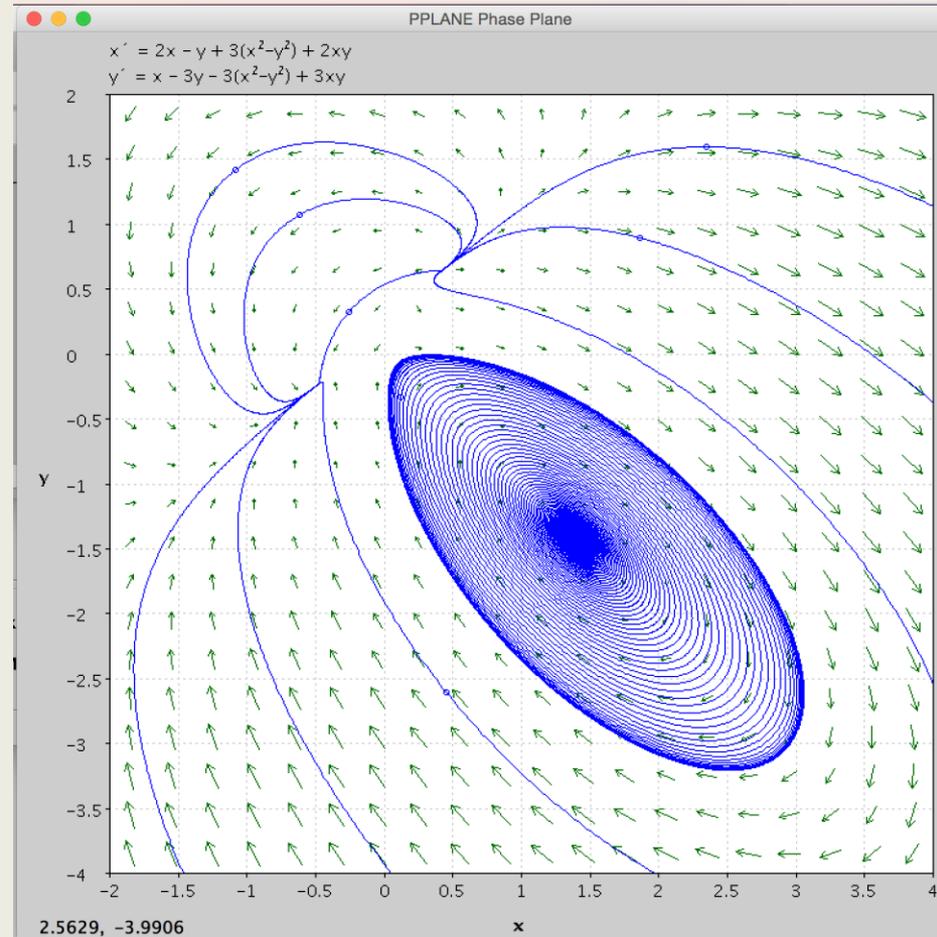
However, it seems to require a lot of steps.

If anyone knows an *easy* way to make this available, please let us know so we can add this help item to our Software Resources.

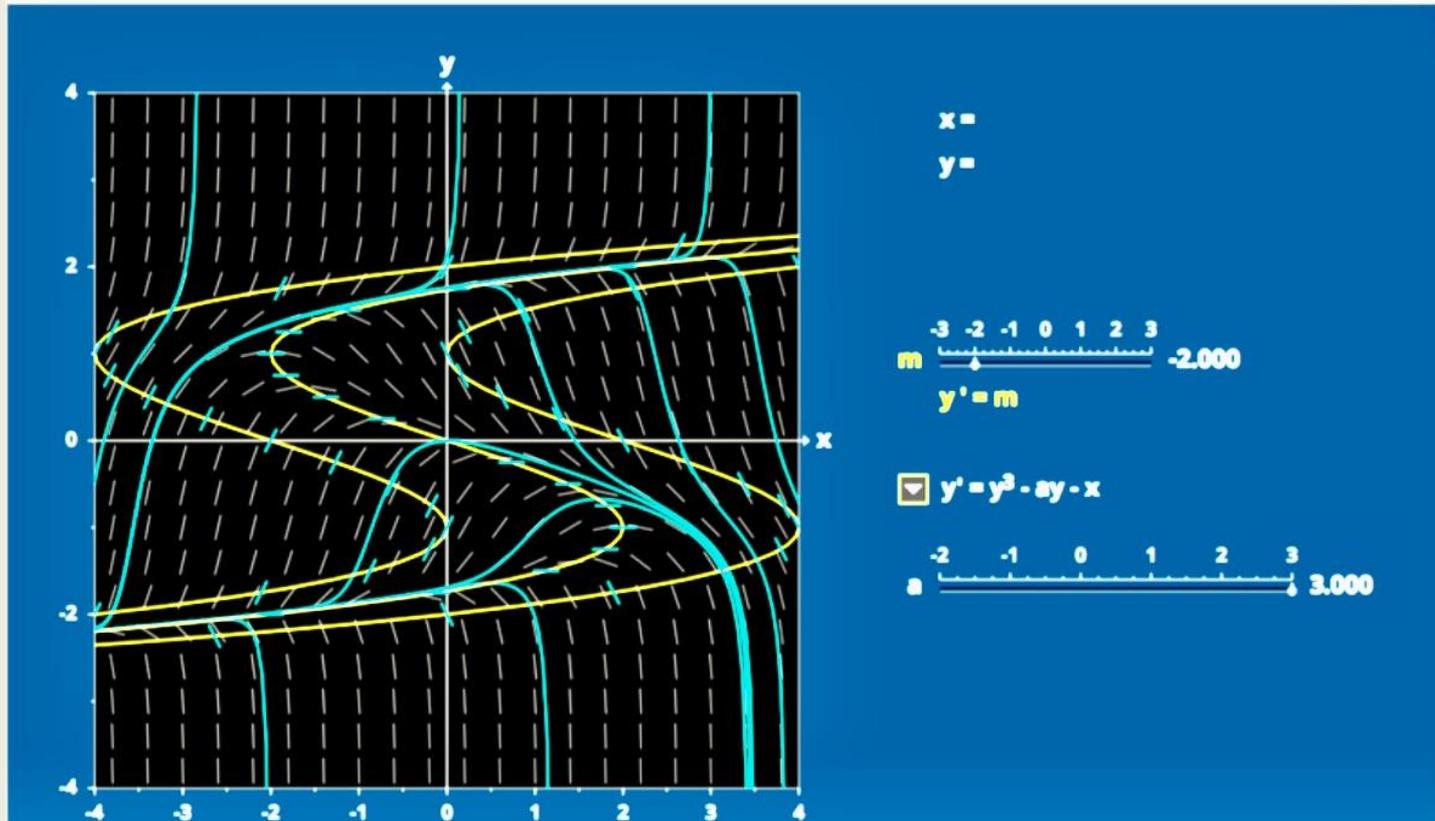
dfield and pplane, by John Polking (Rice University)

These are two great point/click solvers, for 1D or 2D systems of ODEs.

You can enter equations, or change parameters, and just click on the graph to set an initial condition; then solutions draw automatically. .



Interactive Differential Equations (IDE) by Hubert Hohn



A set of >90 interactive illustrations (*not* a solver) that allow student exploration of *concepts*, plus 31 Labs (B. West, S. Strogatz, J. McDill, J. Cantwell).

But new software emerges



ODE software packages designed specifically for mobile devices are very popular with students, and are often used in class for demonstrations (next 2 slides):

- **Slope and Direction Fields, by Darryl Nester (Bluffton Univ):**
- **Slopes by Tim Lucas (Pepperdine University)**

Slope and Direction Fields, by Darryl Nester (Bluffton Univ):

One ODE System Polar ODE Polar system

$dy/dx = 2y*(1-y)$

Variables: dy/dx

$-3 \leq x \leq 3$ with 15 segments
 $-2 \leq y \leq 2$ with 15 segments

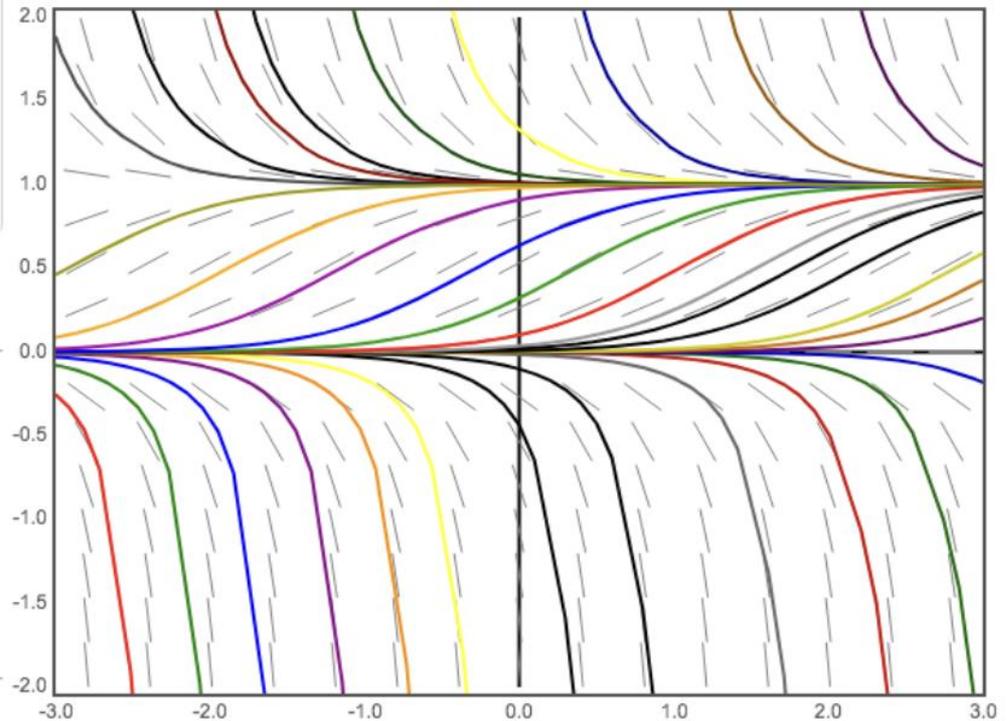
Euler with $h = 0.1$ switching

To specify initial values for solution curves, either:

- enter $(x,y) = (-1, 0)$ submit
- or click on the graph:

clear all curves

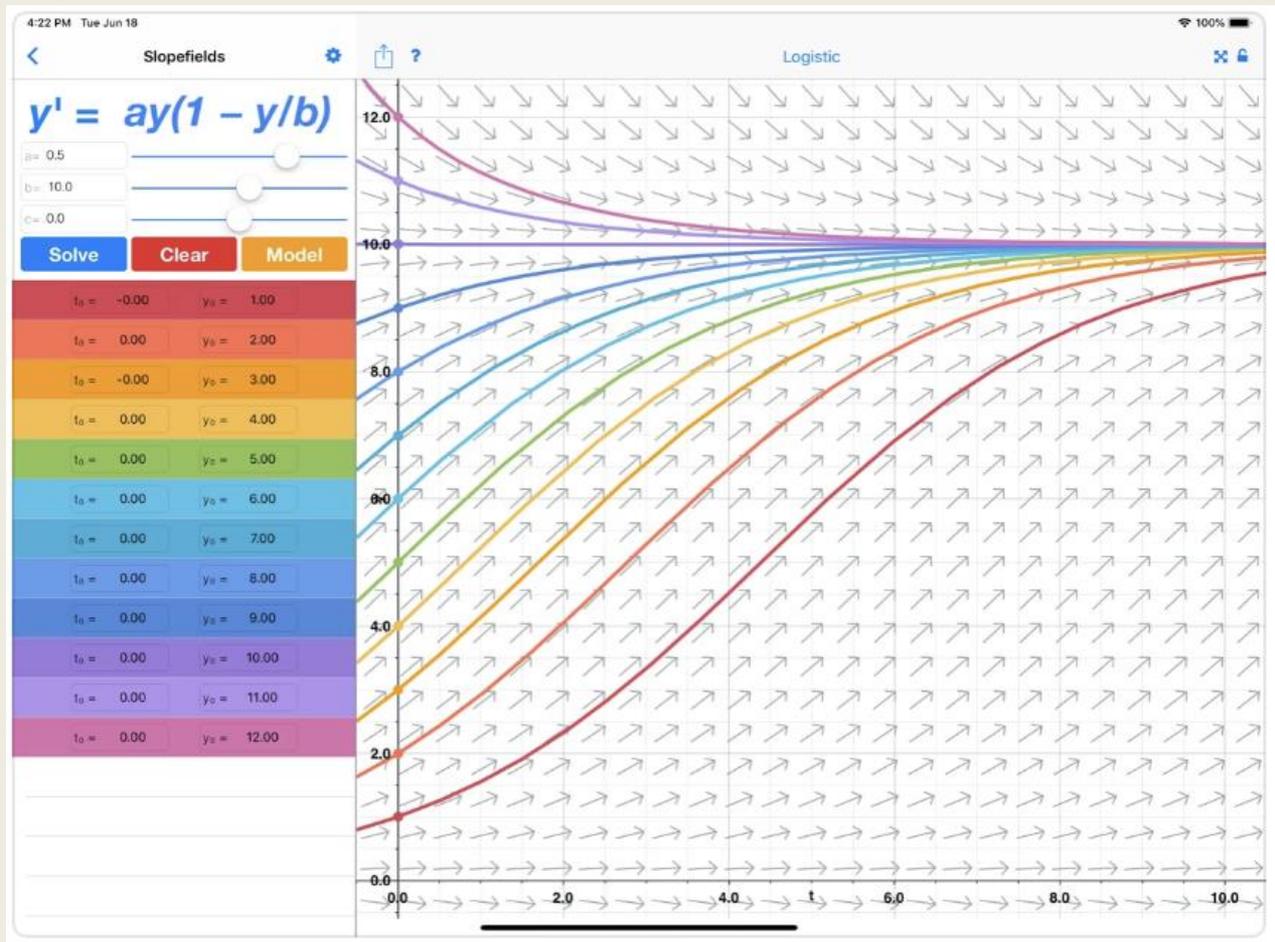
- BDH 1.3 #1
- BDH 1.3 #2
- BDH 1.3 #3



Save settings with [link 1 \(current tab\)](#) or [link 2 \(all tabs\)](#).

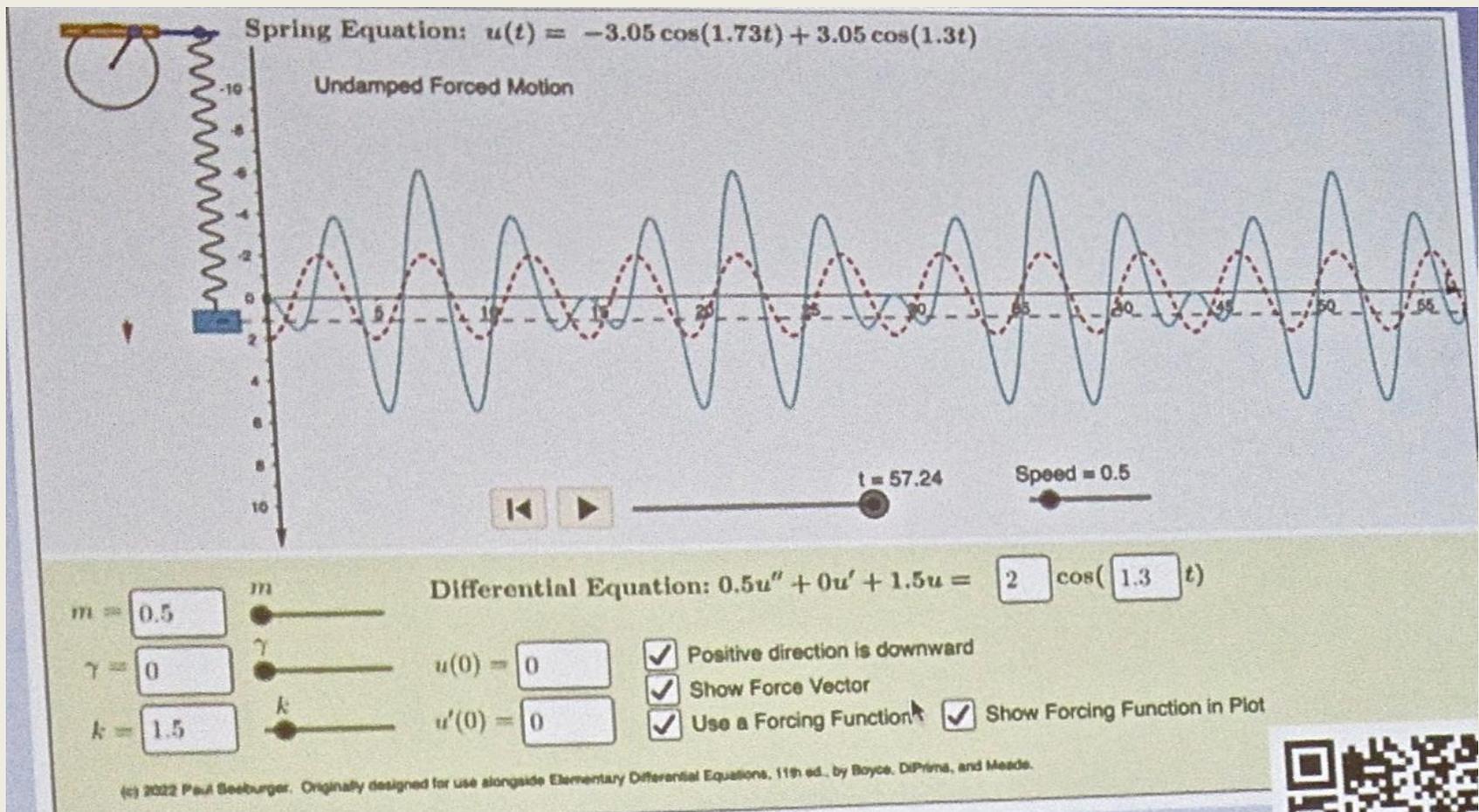
To save the image, right-click this thumbnail: .

Slopes by Tim Lucas (Pepperdine University)



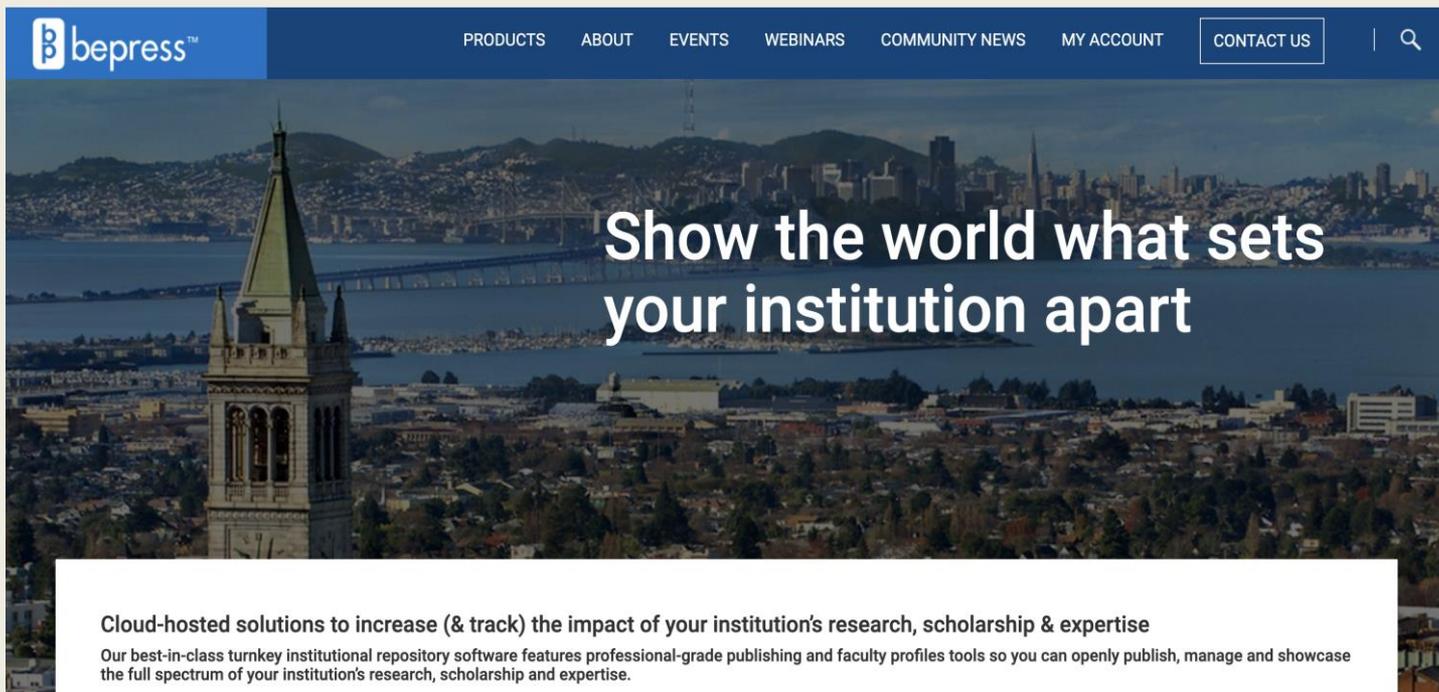
Tim will give a nice demo today at 4:30, in the Main Room

And – a computer-based workhorse: Geogebra-based Visualizations, (Direction Field Explorer, CalcPlot3D) by Paul Seeburger (Monroe Community College)



CODEE: Third NSF Grant

2007: Now that the internet was truly available, Bob Borrelli and Darryl Yong (Harvey Mudd College), with Ami Radunskaya (Pomona College), created the free online open access CODEE Journal, through the Claremont College Libraries, using *Bepress* publishing.



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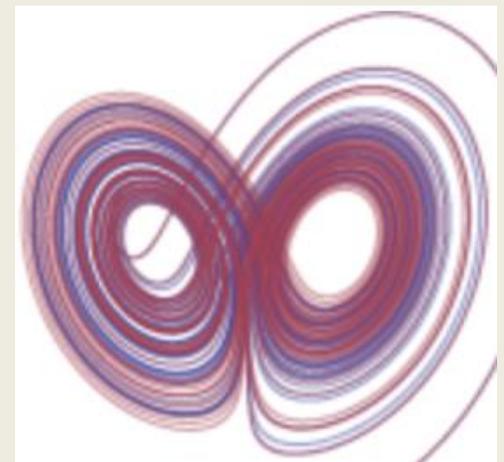
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Our best-in-class turnkey institutional repository software features professional-grade publishing and faculty profiles tools so you can openly publish, manage and showcase the full spectrum of your institution's research, scholarship and expertise.

Name change: CODEE became (Community of Ordinary Differential Equations Educators)

The CODEE Journal published its first issue in **2009**, as Volume 7. (The first 6 volumes are the digitized **CODEE Newsletters** from the first six years; these are accessed through the **Resources** List of **Print Materials**.)

From the very beginning,
the CODEE Journal has been
downloaded *all over the world* !

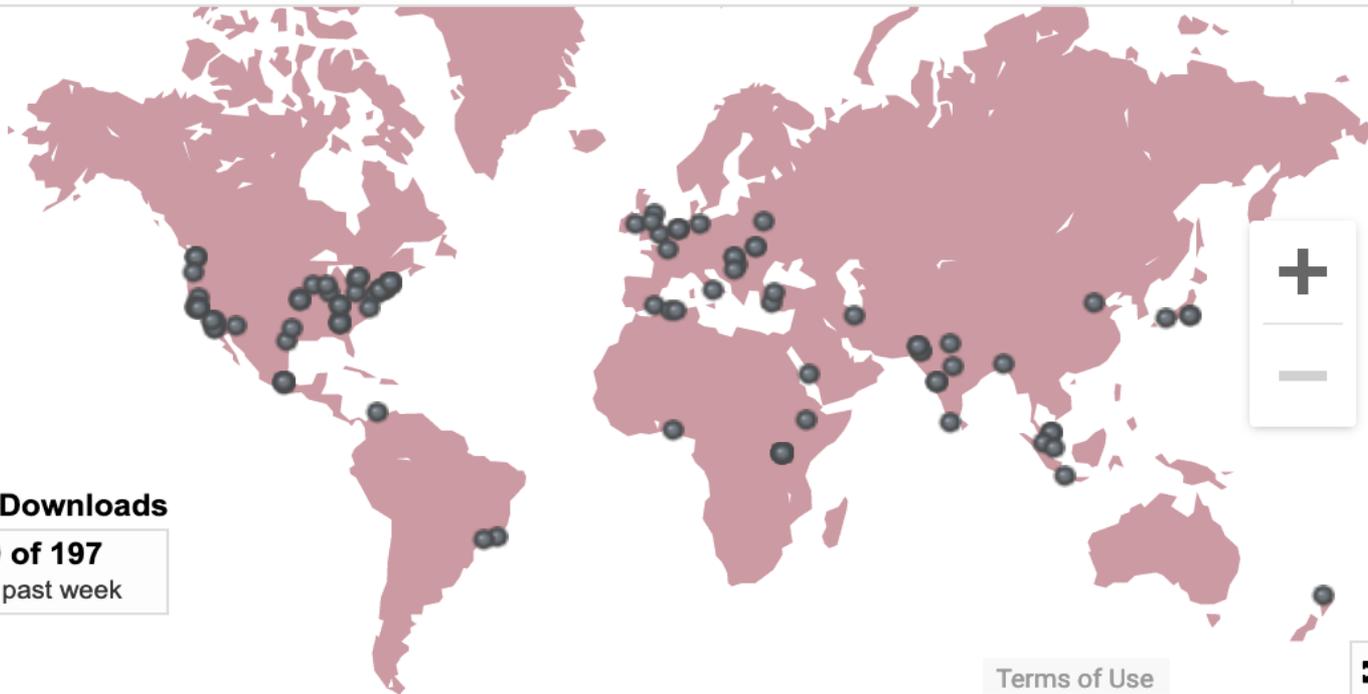


Typical active download map from homepage of CODEE Journal

Reader from:  Kigali, Ville De Kigali, Rwanda

Integrating Factors and Repeated Roots of the Characteristic Equation

Howard Dwyer, William Green



Recent Downloads

179 of 197
in the past week

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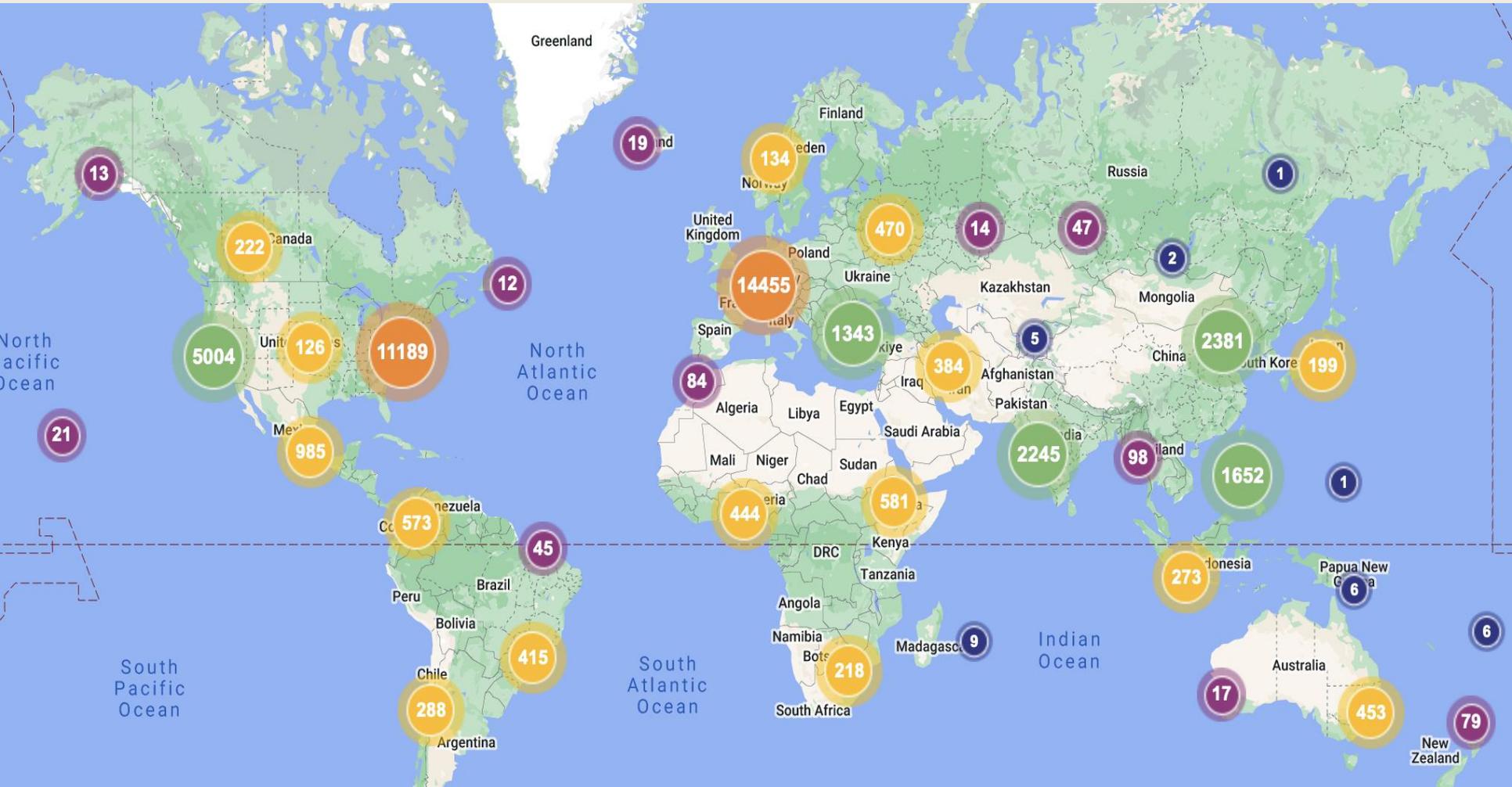
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49
Total Papers

45,788
Total Downloads

9,398
Downloads in the past year

Global Impact of CODEE Journal



Downloads from Nov 2009 – Dec 2022

Rough Download Statistics

From the beginning, ~ 2/3 of the downloads are *outside* the USA!

US 16K

Europe 15K

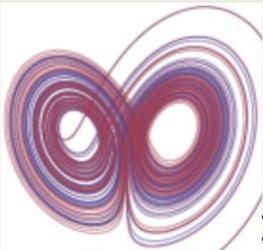
Asia (esp SE) 7K
Mexico, S.A. 2.3K

Mideast 1.7K

Africa 1.5K

Australia, S. Pacific .5K

Other ...

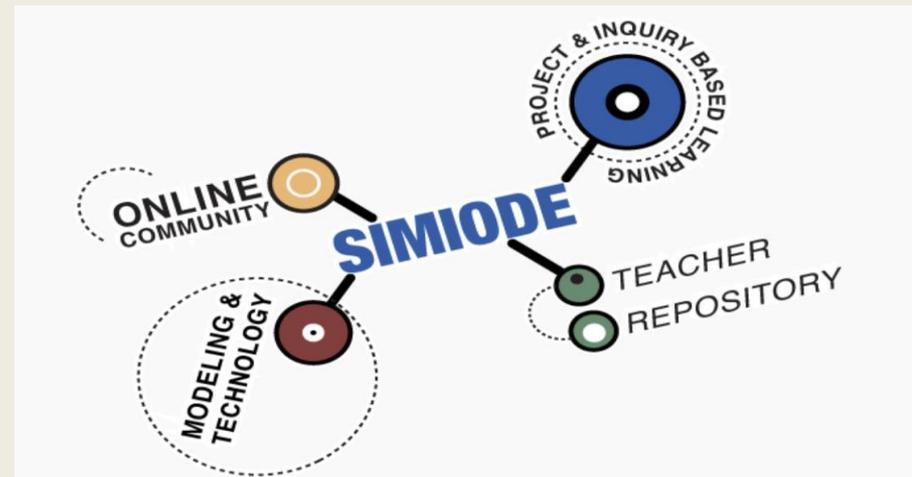


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ore, every single article published in the **CODEE Journal**, from 2009 to 2023 is *still* being downloaded! They show up every time I look at Bepress metrics, as increased number of downloads.

Surely that says something about the long-term relevance of these papers as a valuable resource to folk all over the world.

Downloads are recorded in 167 (so far) out of 195 countries. This global outreach shows that we are fulfilling a special mission. It has been good to focus on that.

SIMBIOSIS!

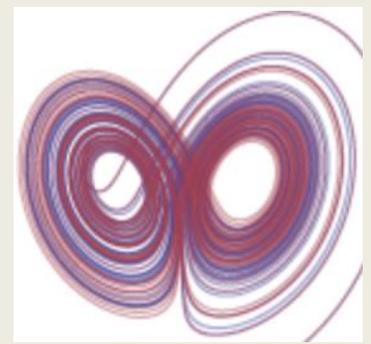


CODEE was delighted when **SIMIODE**, began (~**2013**) and took over the workshops and sessions that attract the enthusiasm of younger colleagues, as did CODEE's original mission. In addition SIMIODE has added a blog, competitions, etc. – taking full advantage of the internet, where data is now hugely available.

What an amazing *new* world we have to work in!

Now CODEE concentrates on the CODEE Journal, and its global impact. So, what's in the CODEE Journal?

CODEE Articles -- have *not* gone out of date!



As of **2023**, 47 articles have been published in the CODEE Journal. Some of the most popular are

Climate Change in a Differential Equations Course: Using Bifurcation Diagrams to Explore Small Changes with Big Effects

Justin Dunmyre, Nicholas Fortune, Tianna Bogart, Chris Rasmussen, and Karen Keene

Teaching an Online Sophomore-Level Differential Equations Course with Mathematica Supplements

William M. Kinney

Modeling the Effects of Avian Flu (H5N1) Vaccination Strategies on Poultry

Cooper J. Galvin, Adolfo Rumbos, Jessica I. Vincent, and Maria Salvato

Epidemiology and the SIR Model: Historical Context to Modern Applications

Francesca Bernardi and Manuchehr Aminian

The Mathematics of Gossip

Jessica Deters, Izabel P. Aguiar, and Jacquie Feuerborn

SIR Models: Differential Equations that Support the Common Good

Lorelei Koss

Popular articles, continued

A Model of the Transmission of Cholera in a Population with Contaminated Water

Therese Shelton, Emma Kathryn Groves, and Sherry Adrian

Kremer's Model Relating Population Growth to Changes in Income and Technology

Dan Flath

An Epidemiological Math Model Approach to a Political System with Three Parties

Sellenne Bañuelos, Ty Danet, Cynthia Flores, and Angel Ramos

Extending Power Series Methods for the Hodgkin-Huxley Equations, Including Sensitive Dependence

James S. Sochacki

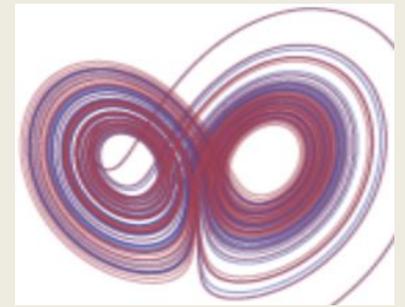
Qualitative Analysis of a Resource Management Model and Its Application to the Past and Future of Endangered Whale Populations

Glenn Ledder

Maintaining Ecosystem and Economic Structure in a Three-Species Dynamical System in Chesapeake Bay

Maila Hallare and Iordanka Panayotova

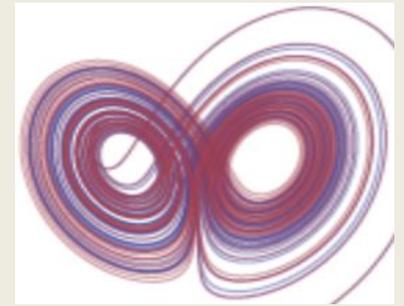
CODEE: Special Issues



We have had two special issues,

- **LINKING DIFFERENTIAL EQUATIONS TO SOCIAL JUSTICE AND ENVIRONMENTAL CONCERNS**
(Volume 12, 2019)
- **ENGAGING LEARNERS: DIFFERENTIAL EQUATIONS IN TODAY'S WORLD**
(Volume 14, 2021)
- and we are just launching a third:

Third Special Issue



ENGAGING THE WORLD: DIFFERENTIAL EQUATIONS INFLUENCE PUBLIC POLICY

(Volume 17, **2023**), edited again by

Samer Habre, Lebanese American University

- Short proposals are due **February 28, 2023**; if accepted, full papers are due **June 6, 2023**.
- For details see the Call for Papers link at <http://codee.org/>. Please consider a paper!

Some motivation:

Chinenye Ofodile's work with his calculus students (in Albany, Georgia) directly attacked this question.

I saw his talk at JMM 2020 in Denver, and we featured his story in our 2nd special issue,

**ENGAGING LEARNERS:
DIFFERENTIAL EQUATIONS
IN TODAY'S WORLD.**

(See CODEE Journal, Vol 14).



“Engaging students early by internationalizing the undergraduate calculus course”

In conclusion:

**CODEE (codee.org) provides a
wealth of materials on its website.**

Resources, in addition to **Articles**, are in the
process of being updated right now.

For the list of all articles so far, you can email

bhw2@cornell.edu

or

maila.hallare@afacademy.af.edu

Thank you!

