

TEAMM Newsletter

Department of Mathematics, University of Massachusetts Dartmouth

July 2022

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ContourPlot3D[  
  (x^2 + 9*y^2/4 + z^2 - 1)^3 - x^2*z^3 -  
  9*y^2*z^3/80 == 0, {x, -3/2, 3/2},  
  {y, -3/2, 3/2}, {z, -3/2, 3/2},  
  ContourStyle -> Red, Mesh -> None,  
  Boxed -> False, Axes -> False]
```



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1 Welcome!

Welcome to the July 2022 [TEAMM](#) (“Together Everyone Achieves More in Mathematics”) Newsletter.

The newsletter is intended to be a chatty, newsy, fun, informative publication, appearing approximately once a month, and in good times every two weeks. Exactly how often the newsletter appears depends to a large extent on what new information, from readers, the editors have to share.

The sort of things the editors are looking for are:

- Big deal happenings - acceptance into graduate school or a major program; an award or other recognition.
- Academic happenings - attendance at a conference, for example.
- Upcoming events - seminars, HS math club meetings, for example.
- Personal events - running a marathon, for example (yes, we’re thinking of you Yanlai).
- Interesting articles or books you’ve come across.
- Interesting puzzles or problems.

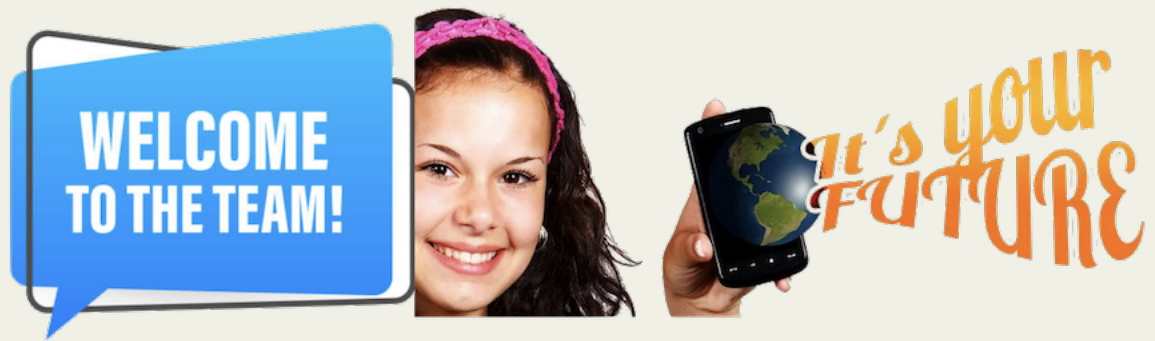


Gary Davis & Adriano Marzullo (editors)

2 New students

Welcome, from our entire math community, to our new first-year mathematics majors, Fall 2022:

- Francesca Jacotin
- Adam Naze
- Elisha Rogatch
- Michael Sawicki
- Jason Motta (Transfer)



3 Who's doing what?

- Scott Field has restarted his vegetable garden, currently growing lettuce, tomatoes, onions, basil, peppers, zucchini, and cucumbers. Rabbits have already eaten most of the lettuce.



- Scott is also co-organizing two summer programs at ICERM: [A](#) and [B](#)
- Shawn Koohy is working, with his REU at Clarkson, on solutions to what is known as the [Allen-Cahn equation](#) and other general reaction-diffusion equations. Shawn plans on going down to North Carolina for a week with some friends, a few days after his program is done. From his time in New York there are a lot of hiking spots that his group has visited such as Stone Valley Trail, Cathedral Rock Fire Tower, and Lampson Falls, and he has also visited Niagara Falls. In a couple of weeks he plans on visiting Montreal for a couple of days, starting Canada Day.
 - At these times of soaring high gas prices, Alfa Heryudono finally got a plane ticket with a reasonable price to Jakarta, Indonesia,

from late July to early August. However, he has to fly from JFK airport in New York, and the journey will take two days with transit in Narita, Japan. After four years, he hopes to see his mom and his hometown for ten days in-person.



As for his regular Summer schedule, he is having research meetings with Scott Field, a graduate student Brian Cornet, and an undergraduate student, Keigan Cullen. In addition, he is advising John Willy, an undergraduate student in computer science, to work on research in iterative methods. A MUST grant funds John in the summer.

- Jill Peters has tickets to several concerts this summer. She and Donna have a family getaway in Maine this summer, and they are making plans to go to the Caribbean - probably St. Lucia, but are looking at a few different islands. In the infamous words of Jimmy Buffett: “I gotta fly to St. Somewhere!”



If time permits, Jill is hoping to squeeze in a trip to Cincinatti to see her son and his fiancé.

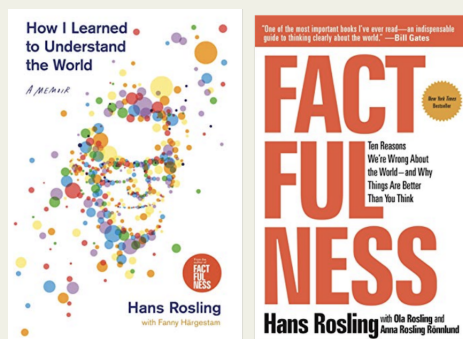
- Bo Dong is taking a trip this summer to Palm Springs (CA) because her son will attend a national chess tournament there.



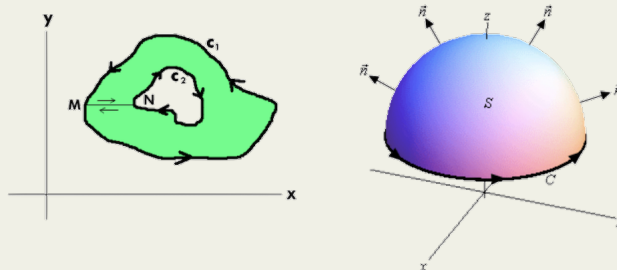
- Sigal Gottlieb is reading the following amazing books about how numbers tell us about the state of the world, and how this can be presented visually!

[How I Learned to Understand the World: A Memoir](#), by Hans Rosling (Author), Dr Anna Paterson (Translator)

[Factfulness: Ten Reasons We're Wrong About the World—and Why Things Are Better Than You Think](#), by Hans Rosling (Author), Anna Rosling Rönnlund (Author), Ola Rosling (Author)



- Sergei Artamoshin is teaching Calculus II asynchronously for the first time, so he is busy developing this course and collaborating with CITS - Instructional Development, who approve the course. which he will teach July - August. Sergei is also working on simplifying the proof of Green's and Stokes' theorems in a way that may help students better understand these calculus concepts.



- Adam Hausknecht has written different versions of a public key RSA encryption-decryption app using both the [Tkinter GUI](#) and the [PySimpleGUI](#). To learn more about PySimpleGUI, Adam worked through an online course at Udemy. Adam is planning to write a Python or JavaScript graphics app on nonsingular elliptic curves and their group law.

He has been learning about the new features of Java 17 and what changes he should make in [TEMATH](#)'s code. A problem is that the older 2D curve drawing code does not support current high-resolution screens, so it will need to be replaced.

Adam had to remove the trees around his house because they were in danger of falling. He has been working with some landscapers to change his front yard:



Adam will likely take several short trips with his sisters: to Newport, the Cape, and Martha's Vineyard.

Donghui Yan is working on a cost-effective test strategy for massive scale Covid-19 testing.



This arose from his conversations at this year's [NESS conference](#) with someone who recently returned from China. It is known that currently, in many places in China, people are required to do regular Covid-19 tests. The massive scale of the test, means the overall cost might be huge. Thus it is desirable to devise strategies to reduce the cost. That reminded Donghui of a blood test strategy used in WWII: since the infection ratio is small, many tests won't find any positive cases. So combine the sample of many into a batch, test it, and if the overall result is negative then everyone in the batch is negative and fine. If the batch is positive then test everyone in the batch.

It might be interesting to ask if the problem could be extended to the case where there might be false positive/negative in tests. Donghui feels this might be a possible project choice for high school or undergraduate students with some knowledge of probability or programming simulation.

4 Upcoming events

The annual [Julia conference](#) will be held virtually July 27-29, 2022:



The conference will include a [JuliaHub 101](#) webinar July 28 from 1:30-2:30 pm Eastern (US). [Click here to register](#).

The Webinar is led by Jacob Vaverka (Julia Computing), an experienced modeling and simulation application developer.

Participation in the Webinar is free but [registration is required](#).

[Julia ranks in the top 5 most loved programming languages for 2022 \(above Python, R and MatLab\)](#)



Hybrid: SIAM Conference on Applied Mathematics Education (ED22)

July 11 - 12, 2022, David L. Lawrence Convention Center, Pittsburgh, Pennsylvania.



“Conference of the SIAM Activity Group on Applied Mathematics Education ... to advance the development and practice of educational programs, courses, and resources in applied mathematics. The constituencies of the SIAG include college and university faculty involved in applied and computational mathematics with a strong interest in educational innovation, practice, improvement, and faculty development”

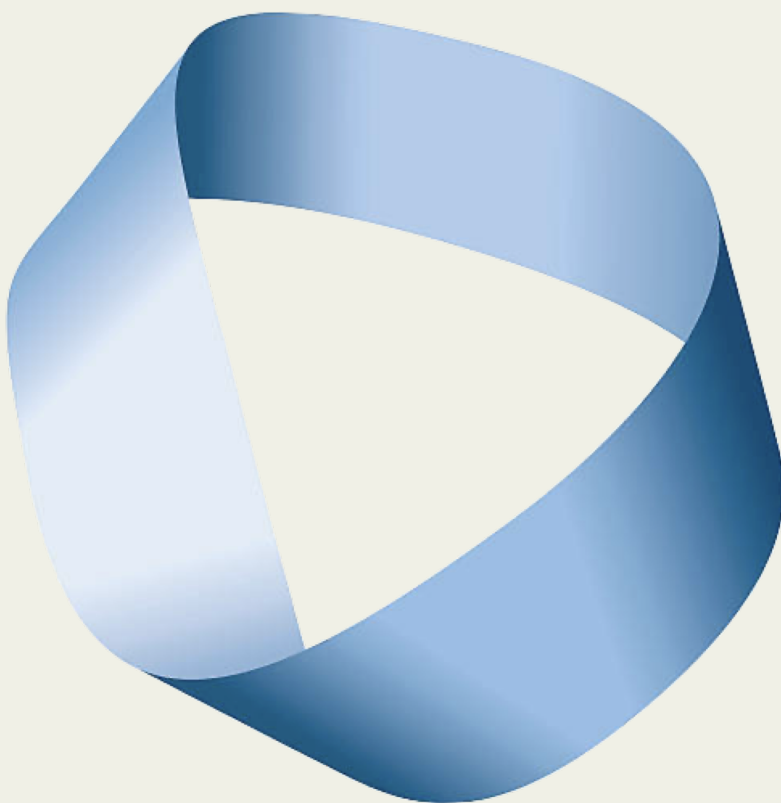


[American Mathematical Society Meetings Calendar](#)

[SIAM Meetings Calendar](#)

5 Mathematical riddles, puns and jokes

Q. Why couldn't the chicken cross the [Möbius strip](#)?



A. Because ... (wait - is this riddle a bit one-sided?)

Q: What is the difference between a Ph.D. in mathematics and a large pizza?

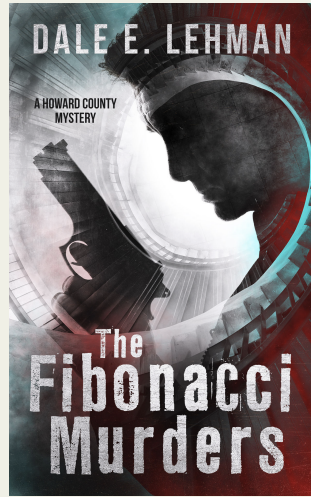


A: A large pizza can feed a family of four...



6 Summer reading?

The Fibonacci Murders:

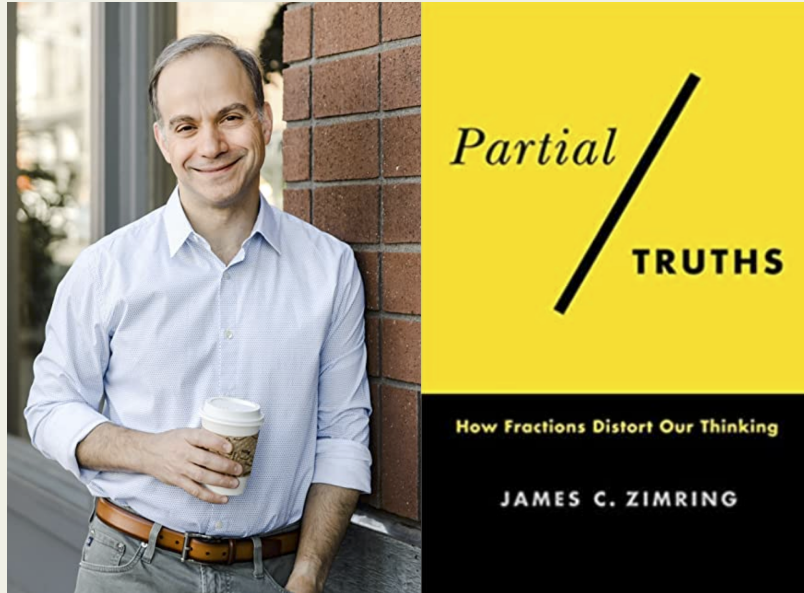


“I start with zero. Nobody dies today.”

The strange note delivered to Howard County, Maryland Detective Lieutenant Rick Peller proves to be a warning shot. Soon Peller and his protégés Detective Sergeants Corina Montufar and Eric Dumas are pursuing a cunning killer basing murders on the Fibonacci series, a mathematical sequence in which each number is the sum of the preceding two. And the only thing Peller knows for sure is that the series never ends.

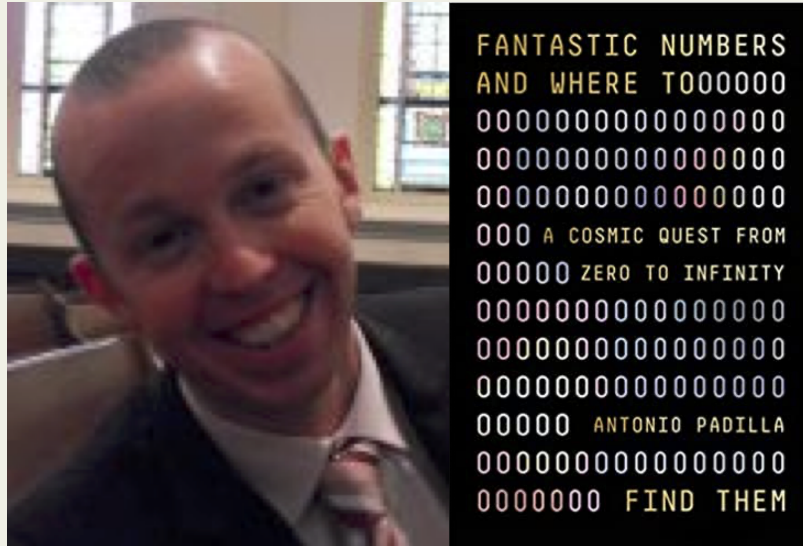
As the murderer switches up methods, locations, and even the meanings of the numbers, questions multiply. Are the murders random, or do they have a purpose? Why is the Pentagon eager to keep a lid on the investigation? Does the killer know Peller? Can the detectives stop him before he commits his final, terrible crime?

Partial Truths: How Fractions Distort Our Thinking by James C. Zimring, Columbia University Press.



“A fast-food chain once tried to compete with McDonald’s quarter-pounder by introducing a third-pound hamburger — only for it to flop when consumers thought a third pound was less than a quarter pound because three is less than four. Separately, a rash of suicides by teenagers who played Dungeons and Dragons caused a panic in parents and the media. They thought DD was causing teenage suicides — when in fact teenage DD players died by suicide at a much lower rate than the national average. Errors of this type can be found from antiquity to the present, from the Peloponnesian War to the COVID-19 pandemic. How and why do we keep falling into these traps? James C. Zimring argues that many of the mistakes that the human mind consistently makes boil down to misperceiving fractions. We see slews of statistics that are essentially fractions, such as percentages, probabilities, frequencies, and rates, and we tend to misinterpret them.”

Fantastic Numbers and Where to Find Them: A Cosmic Quest from Zero to Infinity by Antonio Padilla.



“This delightful book purports to be about numbers, but is really a window onto the astonishing scope and scale of the universe in which we live. You will be amazed at the mind-bending ideas science has proposed in order to grasp reality, and be impressed that our minds are able to bend that far.” Sean Carroll, author of *Something Deeply Hidden: Quantum Worlds and the Emergence of Spacetime*

[Tony Padilla](#) is a theoretical physicist and cosmologist at the University of Nottingham. He is Associate Director of the Nottingham Centre of Gravity and has served as the chair of U.K. Cosmology for over a decade. In 2016, he and his collaborator shared the Buchalter Cosmology Prize for their work on the cosmological constant.

7 From around the world

Australia is failing at math and needs to find a new formula to arrest the decline

Reproduced from phys.org



Divide, subtract, add, multiply: whatever way you cut it, Australia is heading in one direction when it comes to global math rankings—downwards.

From an OECD mathematics ranking of 11 in the world 20 years ago, Australian secondary students are now languishing in 29th place out of 38 countries, according to the most recent statistics.

The sliding math rankings have created widespread debate over whether curriculum changes are needed in schools.

Algorithm predicts which students will drop out of math courses

Reproduced from phys.org



In the so-called MINT subjects—mathematics, computer science, natural sciences and technology—up to 40 percent of students drop out of their studies in the introductory phase.

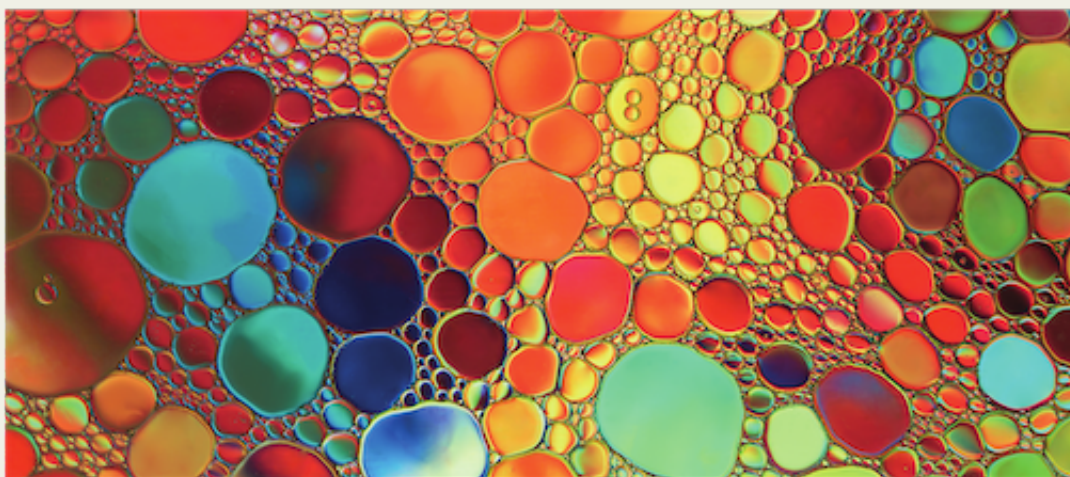
A research team from the Methods Center of the Faculty of Economics and Social Sciences at the University of Tübingen has now developed a statistical method with which students can predict on average eight weeks in advance whether they will drop out of their studies.

Read the full article at phys.org

8 New and noteworthy

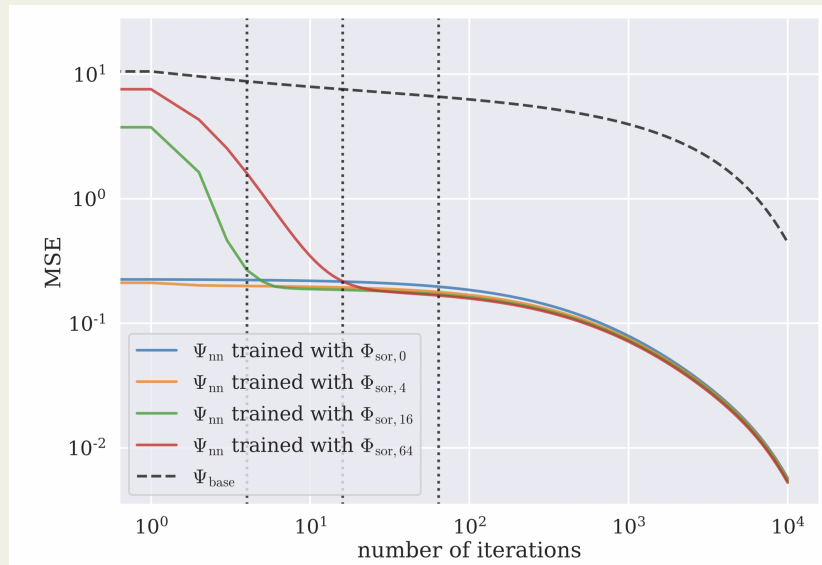
Low-Rank Approximation for Multiscale PDEs

Chen, K., Chen, S., Li, Q., Lu, J., Wright, S. J. (2021). Low-rank approximation for multiscale PDEs. Notices of the American Mathematical Society. June/July 2022.



“Multiscale phenomena are ubiquitous, with applications in many physical sciences and engineering fields: aerospace, material sciences, geological structure analysis, and many others. The different scales often have different physics, which entangle to produce complicated nonlinearities. Partial differential equations (PDEs) are often used to model these problems, with different scales captured in the coefficients and functions that define the PDE. These PDE models are challenging to compute directly, so analysis and algorithms specifically targeted to multiscale problems have been developed and investigated. Following convention, we focus in this review on problems with two distinct scales, with a small positive parameter ϵ capturing the ratio between the small and large scales.”

Accelerating numerical methods by gradient-based meta-solving



Abstract

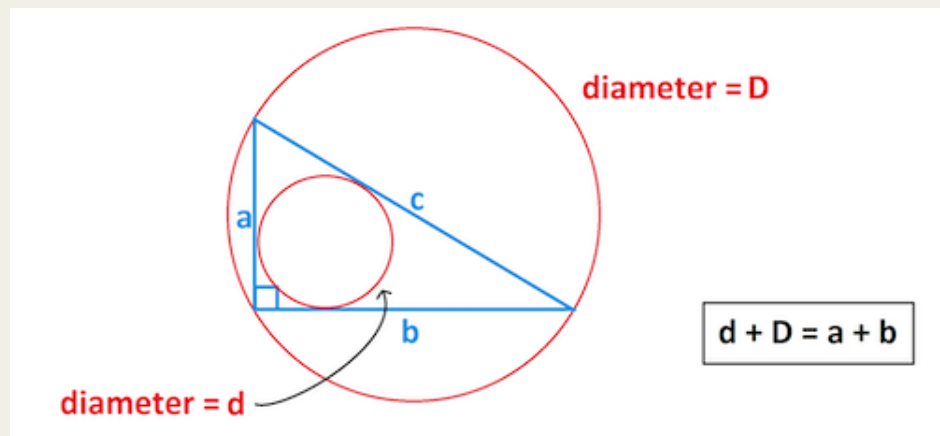
In science and engineering applications, it is often required to solve similar computational problems repeatedly. In such cases, we can utilize the data from previously solved problem instances to improve the efficiency of finding subsequent solutions. This offers a unique opportunity to combine machine learning (in particular, meta-learning) and scientific computing. To date, a variety of such domain-specific methods have been proposed in the literature, but a generic approach for designing these methods remains under-explored. In this paper, we tackle this issue by formulating a general framework to describe these problems, and propose a gradient-based algorithm to solve them in a unified way. As an illustration of this approach, we study the adaptive generation of parameters for iterative solvers to accelerate the solution of differential equations. ...

9 A summer mathematical problem

The **circumscribed circle** of a triangle is a circle that passes through all the vertices of the triangle.

The **inscribed circle** of a triangle is the largest circle contained in the triangle.

Suppose a right triangle has circumscribed circle of diameter D , and inscribed circle of diameter d .



- Show that $d + D = a + b$ where a, b are the lengths of the non-hypotenuse sides of the triangle.
- Does the previous property characterize right triangles? That is, if a triangle has $d + D = a + b$ for two of the side lengths a, b is the triangle necessarily a right triangle (with hypotenuse $c = \sqrt{a^2 + b^2}$), or could there be a non-right triangle with this property?

Thanks to [James Tanton](#) for this problem.

