

**siam**  
**2023**  
**AMSTERDAM**

Conference on  
Computational Science  
and Engineering



# THE ROLE OF MATHEMATICS IN SOLVING THE WORLD'S MAIN CHALLENGES

**PUBLIC EVENT**

**SIAM COMPUTATIONAL SCIENCE AND ENGINEERING  
WEDNESDAY, MARCH 1, 2023**

**PRESENTATIONS FROM 20.00-22.00  
DRINKS AND CONNECTING WITH PARTICIPANTS - 22.00-23.00  
RAI CONGRESS CENTRE - AMSTERDAM - THE NETHERLANDS**

**WHAT DO BLENDERS THAT CRUSH ICE,  
THE POWER GRID, AND FOREIGN  
PATHOGENS ATTACKING THE HUMAN  
BODY HAVE IN COMMON? HOW CAN WE  
GET A CLEARER PICTURE OF CLIMATE  
CHANGE, AND HOW DOES INDUSTRY  
TAKE THE NEXT STEPS IN DESIGNING  
INNOVATIVE PRODUCTS? ALL CAN BE  
MODELLED WITH MATHEMATICS!**

Come to the free public event hosted by SIAM (Society for Industrial and Applied Mathematics) and TU Eindhoven as part of the SIAM Computational Science and Engineering (CSE) conference. This lively event features six dynamic speakers who will give TED-style talks in areas ranging from digital twins and understanding fundamental life processes to climate change solutions and designing a smart power grid to studying smoothies and the stars. Afterward, stick around, enjoy a drink and mingle with some of the 2200 applied and industrial mathematicians who will be in town for the week-long SIAM CSE conference.

So, join us for a fun and educational evening, exploring how mathematics and computing impact us each and every day. Expert speakers will share --- in short talks that both poets and physicists will enjoy --- the many ways computational science increases our understanding of climate, energy, biology, astronomy, and even smoothies. Come be inspired by their scientific achievements and enthusiasm! The evening will be led by **a well-known Dutch celebrity, and Alexander Rinnooy Kan** will end the evening giving his view on the essential role of mathematics for society and industry.

### **FREE ENTRANCE**

Participation is free and registration is not necessary. Come to the RAI and enjoy the talks.

Wednesday – March 1 – 2023  
Amsterdam RAI – entrance G  
Europaplein 24 – Amsterdam

***Mathematics is like oxygen.  
You take no notice of it  
when it's there. If it wasn't,  
you'd realize you cannot do  
without it.***

– Lex Schrijver (CWI, Amsterdam)



## KAREN WILLCOX

Director, Oden Institute for Computational Engineering and Sciences and Professor, Aerospace Engineering and Engineering Mechanics; University of Texas at Austin

### “Digital Twins: The personalized future of computing for complex systems”

Could you imagine one day having a dynamically evolving virtual replica of yourself that your doctor could use to drive personalized decisions to optimize your health and well-being? In engineering, these personalized dynamic computational models are known as digital twins, and are already being used to drive predictive maintenance decisions for aircraft and aircraft engines. This talk will discuss the computational science that goes into creating a digital twin, and will discuss exciting new directions for digital twins in engineering, geosciences and medicine.



## MAGNUS FONTES

General Manager of Institut Roche

### “In Control of Life”

All organisms, including humans, are continuously under attack. The attacks can be intrusions by foreign pathogens, or they can result from some internal part of the living system that goes rogue and threatens the stability of the entire system. Still many of us enjoy stable and healthy existences over extended time-periods. The goal of biomedicine is to support and prolong those healthy states. I will describe how, over the last decades, detailed and massive measurements on living systems, in combination with systems biology models, have revolutionized our understanding of some fundamental life processes. Furthermore, we will look at several examples of how this new knowledge has led to precise and successful interventions to support and control human health.



## KATE EVANS

Director, Computational Sciences and Engineering Division, Oak Ridge National Laboratory

### “Math: the secret key to unlock solutions to climate change”

There are many angles to how our planet experiences climate change, and the grand challenge to understand, adapt to, and mitigate its effects will require every tool in our toolbox. Thankfully, applied mathematics is being put to use to prepare Earth and its neighborhoods for challenges of a warming world. This talk will focus on how math enables us to study the flow of water around the globe, tracking individual cloud droplets, continent-sized weather events, ocean gyres, and ice sheet flow with precision. Changes in water patterns lead to deluges and droughts, so we use math to recreate and analyze ocean and atmosphere behavior using the world’s largest supercomputers.



## LUKE BENNETTS

School of Mathematical Sciences, University of Adelaide

### “Mathematical challenges at the heart of one of Earth’s lungs”

The Southern Ocean is known as one of Earth’s lungs as it is both a massive carbon sink and an oxygen factory. If that wasn’t enough, it also soaks up much of the excess heat produced by human activities. But the Southern Ocean is changing rapidly in response to warming temperatures and a key scientific question is how long it can continue to slow climate change. Breakthroughs in understanding Southern Ocean dynamics are needed to generate higher confidence in models, and hence better resilience for global communities against climate change. I will present a selection of the mathematical challenges at the heart of this grand scientific challenge for our generation.



## CAOIMHE ROONEY

Research Scientist at NASA and  
Co-Founder at Mathematigals



## BERT ZWART

Centrum Wiskunde & Informatica,  
Amsterdam and Eindhoven University of  
Technology

### “Mathematics: from smoothies to the stars”

Ever wonder how blenders manage to chop fruit and smash ice into tiny particles to make the perfect smoothie? Or perhaps you’ve looked up at the night sky and pondered how scientists claim to know what a planet is made of, even though it is hundreds of light-years away? Both of these problems, as well as countless others, can be studied and explained using applied mathematics. In this talk, we will discuss some of the many ways that maths can be applied to further our understanding of the universe, from everyday tasks such as making a smoothie, to unlocking the secrets of the cosmos by searching for signs of life.

### “Designing the smart grid of the future”

The power grid has been one of the most significant engineering achievements in the history of mankind. It has kept our lights on for over a century, but is currently facing immense transformations. To combat climate change, countries increasingly rely on renewable energy generated by solar and wind, but these sources of energy are not always available. How do we keep the lights on in an affordable way, and how do we manage the increasing risk of blackouts? In addition to the many technical, economic, regulatory, and societal challenges, the design and analysis of the future smart grid requires the development of novel mathematical foundations.



## ALEXANDER RINNOOY KAN

University of Amsterdam

Closing of conference by Prof.dr Alexander Rinnooy Kan, on the essential and crucial role of mathematics for society and industry.

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### MORE INFORMATION

[www.siam.org/conferences/cm/conference/cse23](http://www.siam.org/conferences/cm/conference/cse23)



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