

Sessions at the Joint Mathematics Meetings

January 4–7, 2026 • Washington, D.C.

SIAM Coordinating Committee for the Joint Mathematics Meetings

Rebecca Morrison (Chair)
University of Colorado Boulder

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Sandia National Laboratories



SIAM Invited Address

Digital Twins, Generative AI, and Beyond: A PDE–Constrained Optimization Perspective

Harbir Antil, *George Mason University*

Wednesday, January 7, 2026, 10:50 a.m. – 11:40 a.m. • Ballroom A, Walter E. Washington Convention Center

ABSTRACT

Digital Twins (DTs) are adaptive, real-time virtual replicas of physical systems that integrate physics-based models, sensor data, and intelligent decision-making. At their core, DTs can be rigorously framed within PDE–constrained optimization (PDECO).

This talk develops a unified PDECO framework for state estimation and control, leveraging adjoint-based methods in both deterministic and stochastic settings. To address the challenges of infinite-dimensional, large-scale optimization, we introduce novel function-space trust-region and augmented Lagrangian algorithms, and explore the role of randomized methods in dynamic PDECO.

A central theme is a new connection between PDECO and Generative AI: score-based generative models can be interpreted as backward-in-time PDEs, linking ill-posed inverse problems, stability analysis, and modern machine learning. This perspective bridges physics-informed modeling with data-driven synthesis, opening the door to, for instance, score-based Digital Twins.

Applications span a wide range of domains, including structural and biomedical systems—from bridges and dams to aneurysm modeling, optimal insulation, electromagnetic cloaking, light bending, fusion, and neuromorphic computing. Together, these examples highlight a pathway toward predictive, adaptive, and trustworthy Digital Twins and AI technologies.

Harbir Antil is Professor of Mathematics at George Mason University and Founding Director of the Center for Mathematics and Artificial Intelligence (CMAI). His research focuses on optimization, partial differential equations, and scientific computing, with contributions spanning nonsmooth and nonlocal PDE-constrained optimization, uncertainty quantification, reduced-order modeling, and emerging areas in digital twins and scientific machine learning. His work blends rigorous mathematical analysis with scalable computational methods and has been applied in infrastructure health, biomedicine, and neuromorphic imaging.

Dr. Antil's research has been supported by major agencies including NSF, DOE, DARPA, ONR, AFOSR, and DTRA, as well as industry and national laboratories. He serves as an Associate Editor for the *SIAM Journal on Scientific Computing*, *SIAM Review*, and as President of the DC–Maryland–Virginia Section of SIAM. His work has been featured in the *New York Times*, highlighted by NSF and AFRL and has informed applications ranging from CDC ventilation guidelines to real-time imaging aboard the International Space Station.

Special Events

SIAM Panel on Shedding Light on Opportunities for Applied Mathematicians in Industry and Government

Organizers: **Nessy Tania**, *Pfizer* • **Steven Rodriguez**, *United States Naval Research Laboratory*

Javier Armendariz, *Johns Hopkins University Applied Physics Lab*

Monday, January 5, 2026, 8:30 a.m. – 10:00 a.m. • Room 202A, Walter E. Washington Convention Center

The rapidly changing nature of research and development in industry and government provides many new and exciting opportunities for applied mathematicians. Come get an insider's view and see what might await you outside the academic environment. This discussion will feature panelists from a variety of industry and government sectors who will share their "real-world" applied mathematical experiences, offer tips for getting in and building a satisfying career in industry/government.

SIAM Reception on Quantum Science, Artificial Intelligence, and Computational Science

Monday, January 5, 2026, 7:00 p.m. – 9:00 p.m. • Marquis Salon 4, Marriott Marquis

Eat, drink, read, and mingle! This reception is open to everyone. Learn more about how the mathematical sciences connect to emerging challenges and opportunities in the fields of quantum science, artificial intelligence, and high-performance computing while you connect with old and new friends.

SIAM Minisymposia and Joint Session details on reverse.

Society for Industrial and Applied Mathematics (SIAM) is a Level A Partner of the JMM. SIAM sponsors several events including an invited speaker, several minisymposia, and a reception. The program for this meeting will occur in Eastern Standard Time (EST).

Sessions at the Joint Mathematics Meetings

SIAM Minisymposia

SIAM Minisymposium on Approximation Theory

Organizer:

Simon Foucart, *Texas A&M University*

Session I: Sunday, January 4, 2026, 8:00 a.m. – 11:30 a.m.

Session II: Sunday, January 4, 2026, 1:30 p.m. – 5:00 p.m.

Room 152B, Walter E. Washington Convention Center

SIAM Minisymposium on Scientific Machine Learning through the Lens of Numerical Linear Algebra, Optimization, and Inverse Problems

Organizers:

Deepanshu Verma, *Clemson University*

Andrea Arnold, *Worcester Polytechnic Institute*

Elizabeth Newman, *Emory University*

Session I: Sunday, January 4, 2026, 8:00 a.m. – 12:00 p.m.

Session II: Sunday, January 4, 2026, 1:00 p.m. – 5:00 p.m.

Room 152A, Walter E. Washington Convention Center

SIAM Minisymposium on Advances in Mathematical Developments for Computational Plasma Physics Enabling Fusion Relevant Applications

Organizer:

John N Shadid, *Sandia National Laboratories*

Jesus Bonilla, *Los Alamos National Laboratory*

Luis Chacon, *Los Alamos National Laboratory*

Session I: Monday, January 5, 2026, 8:30 a.m. – 12:00 p.m.

Session II: Monday, January 5, 2026, 1:30 p.m. – 4:00 p.m.

Room 152A, Walter E. Washington Convention Center

SIAM Minisymposium on Scientific Machine Learning to Enable Inverse Problems and Uncertainty Quantification for Complex Systems

Organizers:

Bart Van Bloemen Waanders, *Sandia National Labs*

Joseph Hart, *Sandia National Laboratories*

Session I: Monday, January 5, 2026, 9:00 a.m. – 11:00 a.m.

Session II: Monday, January 5, 2026, 1:00 p.m. – 3:00 p.m.

Room 152B, Walter E. Washington Convention Center

Joint Sessions

AMS-SIAM-MAA

Special Session on Research in Mathematics by Undergraduates and Students in Post-Baccalaureate Programs

Organizers:

Darren A. Narayan, *Rochester Institute of Technology*

Khang Tran, *California State University, Fresno*

Christopher O'Neil, *San Diego State University*

Patricia Cahn, *Smith College*

Session I: Sunday, January 4, 2026, 8:00 a.m. – 12:00 p.m.

Session II: Sunday, January 4, 2026, 1:00 p.m. – 5:00 p.m.

Session III: Monday, January 5, 2026, 8:00 a.m. – 12:00 p.m.

Session IV: Monday, January 5, 2026, 1:00 p.m. – 5:00 p.m.

Room 151B, Walter E. Washington Convention Center

SIAM Minisymposium on The Mathematics of Digital Twins and Its Applications

Organizers:

Harbir Antil, *George Mason University*

Keegan Kirk, *George Mason University*

Rohit Khandelwal, *George Mason University*

Sarwati Shah, *George Mason University*

Session I: Tuesday, January 6, 2026, 8:00 a.m. – 12:00 p.m.

Session II: Tuesday, January 6, 2026, 1:00 p.m. – 5:00 p.m.

Room 152A, Walter E. Washington Convention Center

SIAM Minisymposium on Geometric & Topological Data Analysis with Applications

Organizers:

Zachary Johnston Grey, *NIST*

Gunay Dogan, *National Institute of Standards and Technology, Gaithersburg*

Session I: Tuesday, January 6, 2026, 8:30 a.m. – 12:00 p.m.

Room 152B, Walter E. Washington Convention Center

Session II: Wednesday, January 7, 2026, 1:00 p.m. – 5:00 p.m.

Room 152A, Walter E. Washington Convention Center

SIAM Minisymposium on Recent Advances in Numerical Linear Algebra

Organizers:

Silvia Gazzola, *Università di Pisa*

Eric de Sturler, *Virginia Tech*

Tuesday, January 6, 2026, 2:00 p.m. – 5:00 p.m.

Room 152B, Walter E. Washington Convention Center

MAA-SIAM-AMS

Hrabowski-Gates-Tapia-McBay Lecture

Speaker:

Ryan Hynd, *University of Pennsylvania*

Tuesday, January 6, 2026, 9:00 a.m. – 10:00 a.m.

(followed by panel ending at 10:50 a.m.)

Ballroom A, Walter E. Washington Convention Center

JPBM

Communications Award Lecture

Speaker:

Noah Giansiracusa, *Bentley University*

Wednesday, January 7, 2026, 1:00 p.m. – 2:05 p.m.

Ballroom A, Walter E. Washington Convention Center

MAA-AMS-SIAM

Gerald and Judith Porter Public Lecture

Speaker:

Étienne Ghys, *Ecole Normale Supérieure de Lyon*

Sunday, January 4, 2026, 10:50 a.m. – 11:55 a.m.

Ballroom A, Walter E. Washington Convention Center