FROM THE EDITORS

The 2023 Society for Industrial and Applied Mathematics Conference on Computational Science and Engineering

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This note gives highlights and key takeaways from Computing in Science & Engineering *editors who attended the 2023 Society for Industrial and Applied Mathematics Conference on Computational Science and Engineering. The editors discuss themes such as the benefits of returning to in-person conferences, progress in scientific software development and adoption, domain-specific languages, machine learning applications, and community building activities. The editors provide their perspectives on notable sessions and presentations from the conference.*

The 2023 Society for Industrial and Applied Mathematics (SIAM) Conference on Computational Science and Engineering (CSE23),[a] was held in Amsterdam, The Netherlands, 26 February–3 March 2023. For many years, this conference has been a focal event for portions of our community. In this article, the *Computing in Science & Engineering* (*CiSE*) editors who attended SIAM CSE23 share their impressions with our readers.

A CHANCE ENCOUNTER: THE RETURN OF IN-PERSON ATTENDANCE

Damian Rouson

As with many times in the past, one of my most valuable experiences attending a conference came from a chance encounter. At SIAM CSE23, I met someone on the editorial board of a journal I plan to submit to, and our conversation provided valuable insights into machine learning (ML), a research area I'm new to. We started discussing the journal's requirements and successful submission characteristics, but soon dived into technical topics. Our exchange has already begun to influence my research direction, and I'm grateful for the opportunity to have met this expert in the field.

Before the conference, I had a moment of panic when I realized that there was no remote attendance option. My passport was expired and I worried that a renewal would not happen in time. Luckily, my new passport arrived just in time—two days before the event—and I made it to Amsterdam!

I can only imagine how challenging the decision must have been for the conference organizers on whether to offer remote participation. The many factors to consider include economic, equity, access, and technology concerns. On the other hand, the in-person-only format may have led to higher attendance at the conference. The chance to meet experts in the field and have impromptu conversations about research is a unique aspect of in-person attendance that is hard to replicate in a virtual event. Although virtual options may be necessary for some, I don't think the benefits of in-person attendance should be underestimated.

Returning to in-person attendance at conferences is a welcome development for me. The opportunity to

[a]https://www.siam.org/conferences/cm/conference/cse23

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connect with colleagues, learn about new research, and make meaningful connections is invaluable. I was delighted by my chance encounter at SIAM CSE23, and I'm looking forward to attending more conferences in person.

PROGRESS ON SCIENTIFIC SOFTWARE

Konrad Hinsen

My field of research, computational biophysics, was not represented at the conference because SIAM is all about applied mathematics and the CSE conference is about new developments in that field. While biomolecular modeling heavily uses numerical methods, they have not changed much over the last decades. Innovation happens one layer above, in the evermore ingenious ways to combine well-known numerical techniques in highly problem-specific ways.

Nevertheless, I found interesting topics in several minisymposia on the social and technical challenges around scientific software: making it FAIR and sustainable, improving its reliability and performance, teaching software skills to young (and not so young) scientists. I also discovered a German research and development project around knowledge management in CSE (the Mathematical Research Data Initiative),[b] which has a lot of overlap with similar ongoing work in computational biophysics and structural biology.

The conference was also an occasion to finally meet people in person with whom I have been in contact by mail, social networks, and video calls for a few years already. This includes a few members of the *CiSE* editorial board; the pleasures of postpandemic life!

MORE PROGRESS ON SCIENTIFIC SOFTWARE

Jeffrey Carver

Like for Konrad, SIAM is not my primary community, however, I do find some interesting overlaps around research software. The minisyposium "An Update on Scientific Software,"[c] which I co-organized, had four presentations, including two by *CiSE* board members.[1] The presentations and ensuing discussion focused on important topics. The first topic focused on how to teach software engineering practices to students and researchers. The second topic addressed how FAIR models and the tools that implement them can facilitate open science. The third topic focused on how to improve the pull-review process. The last topic centered on whether software metrics could be useful for research software quality. The slides from the presentations are available on figshare.[d]

IMPORTANT DISCUSSIONS ON BRIDGING GAP BETWEEN HIGH-PERFORMANCE COMPUTING SOFTWARE AND ACADEMIC RESEARCH

Irina Tezaur

An important theme relevant to *CiSE* that came up at SIAM CSE23 is that of challenges/strategies for bridging the gap between high-performance computing (HPC) software and academic research. This issue was discussed at length by the plenary presentation "How Open-Source Is Changing Scientific Computing in Industry and Research: Lessons Learned From 25 Years of Deal.II."[e] Topics such as how to reward software development and maintenance in academia were brought up. The need for research software engineers in academic groups was highlighted. The same theme was touched in MS217 and MS254, "Bridging the Gap From HPC Software Engineering to Academic Research,"[f] organized by Keita Teranishi (Oak Ridge National Laboratory), Jeff Young (Georgia Tech), and Alessandro Orso (Georgia Tech). I gave a talk in this session, advertising the *CiSE* special issues "The Future of Research Software Engineers in the United States—Part I"[2] and "The Future of Research Software Engineers in the United States—Part II."[3]

PROGRESS ON DSLs

John Shalf

I was very interested in the progress made in promoting cooperation across the domain-specific language (DSL) community, which has been facilitated by the Multi-Level Intermediate Representation (MLIR) project.[g] In past CSE conferences, the DSL community seemed fragmented, with each offering its own vertically integrated framework. Minisymposia on DSLs have focused on the syntactic efficiency of their language approach, but the burden of maintaining and optimizing back ends to take that DSL syntax and produce optimized code seemed like a nearly impossible task for a small team of programmers. In this CSE, I saw an emerging mass movement to adopt MLIR as an intermediate representation for DSLs. Although

[b]https://www.mardi4nfdi.de/about/mission
[c]https://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=75726
[d]https://doi.org/10.6084/m9.figshare.c.6446179.v2
[e]https://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=76300
[f]https://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=75661
[g]https://mlir.llvm.org/

MLIR was originally developed to support a description of ML models in the intermediate representation—thereby preserving the semantics of the ML model from the original code—in the CSE sessions, it was clear that the DSL community is augmenting the MLIR to provide extensions to also represent semantics that are important to its community. This provides a means to share a common optimizing compiler back end across DSLs, and to also make the code generation a shared artifact. Perhaps this could make DSLs tractable and maintainable with this much deeper sharing of resources. xDSL[h] was particularly interesting because it provides Python hooks for manipulating the MLIR elements so that optimization passes on an MLIR representation can be readily implemented in a scripting language like Python. This greatly lowers the barrier to writing optimizers and makes the future of DSLs much brighter.

ML FOR SCIENCE

Rio Yokota

The number of minisymposia related to ML has increased steadily. Reduced-order modeling, data-driven methods, and neural networks for differential equations have been popular for quite a while now. This year also had some minisymposia on algorithmic aspects of ML, such as "Alleviating the Memory Footprint of Backpropagation," and "Forward Alternatives to Back-Propagation in ML and Science." Another area of computing driven by the ML market is low-precision linear algebra. Whether scientific computing will be able to extract the full potential of future hardware depends on novel linear algebra methods that can tolerate low precision for the individual operations while compensating for the error in some way. Just like we found a way to extract the full potential of gaming cards 15 years ago, I am optimistic that we can do the same with low-precision architectures for deep learning inference.

COMMUNITY BUILDING

Anshu Dubey

Every edition of SIAM CSE includes activities that are helpful to the members of the community. This edition had two panels: one targeted at early-career and another targeted at midcareer researchers. The topics included network building, mentoring, and transitioning to leading roles in research, among others. For students, especially those coming from underrepresented groups, the Sustainable Horizons Institute has offered guided affinity groups for the last few editions. These groups are led by an established researcher and composed of a small group of students. The leaders typically guide the students in navigating the conference by helping select sessions that might be of interest and are beneficial to the group, and often interact with students during those sessions online. This year's guided affinity group activity was lower key than in the past, and I am hoping that it comes back in full force in the next edition.

[h]https://xdsl.dev/

REFERENCE

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