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Digital Twins for the Electrical System: A Symposium

July 26, 2023

JULY 26, 2023 (all times EDT)

[Digital Twins for the Electricity System - A Workshop | National Academies](#)

- 11:00 a.m. **Welcome**
Brent Heard, NASEM
- Motivation from the Department of Energy and National Science Foundation**
Bill Spatz, Program Manager - DOE
David Manderscheid, Division Director for the Division of Mathematical Sciences - NSF
- 11:25 a.m. **Digital Twins and the Electric System Groundwork**
Tom Overbye, Texas A&M University
Irene Qualters, Los Alamos National Laboratory
Eric Hines, Tufts University
Moderated by **Vonu Thakuria**, Rutgers University
- 12:10 p.m. Break
- 12:25 p.m. **Existing Efforts and Methods**
Osman Ahmed, Pacific Northwest National Laboratory
Achalesh Pandey, General Electric
Mikhail Chester, Arizona State University
Moderated by **Xinyue Ye**, Texas A&M University
- 1:40 p.m. Break

- 1:55 p.m. **Unique Challenges for Digital Twins of the Grid**
Mario Bergés, Carnegie Mellon University
Kamran Hassan, Green Mountain Power
Hantz Pr sum , Vermont Electrical Power Company
Mihai Anitescu, Argonne National Laboratory
Moderated by **Bill Spatz**, Department of Energy
- 3:40 p.m. Break
- 3:55 p.m. **Open Discussion**
Devin Van Zandt, Electrical Power Research Institute
Omar Ghattas, University of Texas at Austin
Emma Stewart, Idaho National Laboratory
Moderated by **Junping Wang**, National Science Foundation
And **Alireza Ghassemian**, Department of Energy
- 4:55 p.m. **Conclusion**
Brittany Segundo, NASEM

Panelist Biographies



For 38+ years, **Dr. Osman Ahmed** has created innovation wealth—both intellectual and capital and demonstrated his ability as a successful visionary, strategic, and technical leader. For the last 27+ years, he has led innovation that spans complete digital ecosystem using IoT, predictive analytics, and AI/ML solutions, and across many energy sectors such as buildings, smart cities and infrastructure, smart grid, manufacturing, and mobility. Currently, he serves as a Principal Technical Advisor at Pacific Northwest National Laboratory. He is leading a Digital Twin project for Hydropower Plant and contributing in developing a vision and strategic roadmap for Digitalization for wind energy. His work was recently featured in the Wall Street Journal. Prior to PNNL, he served at Siemens for about 28 years assuming various technical and leadership positions. Dr. Ahmed is a prolific inventor and has more than 43 patents granted by the US patent office.



Mihai Anitescu is a Senior Computational Mathematician in the Mathematics and Computer Science Division at Argonne National Laboratory and a Professor in the Department of Statistics at the University of Chicago. His research interests include numerical optimization, computational science, numerical analysis, and uncertainty quantification. He has used techniques from these areas for critical applications in the power grid and related infrastructure, nuclear engineering, materials science, geosciences, chemistry, chemical engineering, and signal processing. He has co-authored more than 150 peer-reviewed papers in scholarly journals, book chapters, and conference proceedings. He is a member of the editorial boards of the SIAM Journal on Optimization and Optimization Methods of Software, and he was a member of the editorial board of four other journals. He has been a Society for Industrial and Applied Mathematics (SIAM) Fellow since 2019.



Mario Bergés is a professor in the Department of Civil and Environmental Engineering at Carnegie Mellon University (CMU), and a Scholar at Amazon. At CMU, he is interested in making our built environment more operationally efficient and robust through the use of information and communication technologies, so that it can better deal with future resource constraints and a changing environment. Currently his work largely focuses on supporting autonomous systems (buildings, space habitats and other physical infrastructure assets) by developing digital twin frameworks through which software and human agents can interact with them.



Dr. Mikhail Chester is the Director of the Metis Center for Infrastructure and Sustainable Engineering at Arizona State University where he runs a research program focused on preparing infrastructure and their institutions for the challenges of the coming century. He is a professor in Civil, Environmental, and Sustainable Engineering. His work spans climate adaptation, disruptive technologies, innovative financing, cybersecurity, and modernization of infrastructure management. He is broadly interested in how we need to change infrastructure governance, design, and education for the Anthropocene, an era marked by acceleration and uncertainty. He has recently published two books: *The Rightful Place of Science: Infrastructure in the Anthropocene*, and *Urban Infrastructure: Reflections for 2100*, both available on Amazon.



Dr. Omar Ghattas is Pratt Chair in Engineering and Professor of Mechanical Engineering at The University of Texas at Austin. He is also the Director of the OPTIMUS (OPTimization, Inverse problems, Machine learning, and Uncertainty for complex Systems) Center in the Oden Institute for Computational Engineering and Sciences. Ghattas's research focuses on advanced mathematical, computational, and statistical theory and algorithms for complex high-dimensional inverse and optimization problems in computational science and engineering.

Kamran Hassan



Eric Hines, Ph.D., P.E. directs the offshore wind energy program at Tufts University. With over 25 years of engineering experience, he has led a wide range of offshore wind projects including the Wind Technology Testing Center in Charlestown, MA; the New Bedford Marine Commerce Terminal; Digital Twinning the Block Island and Coastal Virginia Offshore Wind Farms; and Transmission Expansion Planning for U.S. Offshore Wind Energy. He works at the technology/policy interface to develop systems-level design concepts and has received numerous awards for his work in use-inspired research and teaching. He studied engineering and public policy as an undergraduate at Princeton University and as a Fulbright Fellow in Germany. He holds an M.S. in applied mechanics and a Ph.D. in structural engineering from the University of California, San Diego.



Thomas J. Overbye is a Professor and holder of the O'Donnell Foundation Chair III in the Department of Electrical and Computer Engineering at Texas A&M University (TAMU) working in the area of large-scale electric power systems. He is also the director of the Texas A&M Engineering Experiment Station Smart Grid Center. Prior to joining TAMU in 2017 he was a Professor at the University of Illinois at Urbana-Champaign. He received his BS, MS, and Ph.D. degrees in Electrical Engineering from the University of Wisconsin-Madison. Before starting his academic career he was employed with Madison Gas and Electric Company.

He is the original developer of PowerWorld Simulator, a co-founder of PowerWorld Corporation, an author of a widely used Power System Analysis and Design book, and is a member of the US National Academy of Engineering.



Achalesh Pandey is the VP for Artificial Intelligence and General Manager for Market Management Business Unit at GE Digital. In this role, Achalesh is leading an outstanding global team developing and delivering electricity market management software to ISO, RTO, and TSO customers across the globe. He is also leading strategy and initiatives in GE Digital Innovation Center to help drive innovation in the energy transition area. He is driving several smart grid and AI initiatives to deliver a reliable, resilient, affordable clean energy grid. Prior to this role, Achalesh was the Executive Technology Director for Artificial Intelligence at GE Research, overseeing six AI research labs across the globe. Achalesh has been with GE for 19 years in various leadership and technologist roles across GE businesses. He has extensive research and development experience in Machine Learning, Prognostics

Health Management (PHM), AI-Assisted Inspection, Digital Twin, Condition based maintenance (CBM), Monitoring & Diagnostics, data mining, advanced sensing, and controls. Before joining GE, Achalesh worked for eight years in the Power Generation Industry with various multinational utilities all across the globe. Achalesh has filed over 50 patents, including 25+ granted patents and, has 20+ GE internal and external publications.



Hantz Pr sum  is the director of VELCO's System Planning Group having served at the company since 2001. In his current role, Hantz conducts long-term planning studies, non-transmission alternative (NTA) studies, as well as generator interconnection studies. Hantz leads the Vermont 20-year transmission long-range plan effort, which informs stakeholders of potential system concerns due to electrification load growth or distributed generation growth. Prior to joining VELCO, he worked for ten years as a Planning Engineer at what was then Boston

Edison, now Eversource, producing studies on long-term planning, large generator

interconnection, and a number of exploratory scenarios. Hantz currently serves on the Reliability Coordinating Committee of the Northeast Power Coordinating Council, New England Power Pool's Reliability Committee, and ISO-NE's Load Forecast Committee and Distributed Generation Forecast Working Group. He received an MSEE in Power Systems from Northeastern University and an MBA from Boston College.



Irene Qualters serves as the Associate Laboratory Director for Simulation and Computation at Los Alamos National Laboratory, a U.S. Department of Energy national laboratory. She previously served as a Senior Science Advisor in the Computing and Information Science and Engineering (CISE) Directorate of the National Science Foundation (NSF), where she had responsibility for developing NSF's vision and portfolio of investments in high performance computing, and has played a leadership role in interagency, industry, and academic engagements to advance computing. Prior to her NSF career, Irene had a distinguished 30-year career in industry, with a number of executive leadership positions in research and development in the technology sector. During her 20 years at Cray Research, she was a pioneer in the development of high performance parallel processing technologies to accelerate scientific discovery. Subsequently as Vice President, she led Information Systems for Merck Research Labs, focusing on software, data and computing capabilities to advance all phases of pharmaceutical R&D.



Dr. Emma Stewart, is the chief power grid scientist at INL. Prior to this role she was the chief scientist at NRECA and led initiatives on cybersecurity, resilience and federally funded R + D for over 900 electric co-ops. Emma has over 15 years experience in power systems, resilience and sensing including as the Associate Program Leader for Defense Infrastructure at Lawrence Livermore National Laboratory where she led a research team in providing assured power and emergency restoration solutions for critical facilities, advanced sensing and measurement for resilience and cyber applications. Emma also led teams at LBNL, and DNV GL in distribution grid analysis and analytics, along with performing interconnection analyses for multiple utilities and state organizations. Emma developed the first distribution-synchrophasor network within the US grid, with the data currently in use in many R + D activities throughout the national lab and industrial network. She received her PhD in Electrical Engineering in 2009, and Masters in Electrical and Mechanical Engineering in 2005, both from University of Strathclyde in Scotland.



Mr. Devin Van Zandt is currently leading EPRI's efforts related to assessing the grid impacts of Distribution Energy Resources (DER). His primary research involves developing modeling methods and guidelines for evaluating DER connected to distribution systems. Mr. Van Zandt is also deeply involved in

analyzing the performance of microgrids and DER management approaches to provide system flexibility. Mr. Van Zandt is a customer-focused leader and power systems engineer with a proven track record of developing innovative software tools for transmission and distribution applications and providing consulting services. Prior to joining EPRI in June 2018, Mr. Van Zandt spent 28 years in a variety of roles working for General Electric including the development and strategic direction of GE's commercial planning software products: PSLF, MAPS, and MARS.