NSF NANOSCALE SCIENCE AND ENGINEERING GRANTEES CONFERENCE:

NANO AND AI CONVERGENCE

DECEMBER 9-10, 2024

"Nano-AI Convergence: Overview"

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Bio: Dr. Wei Chen is the Wilson-Cook Professor in Engineering Design and Chair of Department of Mechanical Engineering at Northwestern University. Directing the Integrated DEsign Automation Laboratory (IDEAL-http://ideal.mech.northwestern.edu/), her current research involves the use of statistical inference, machine learning, and uncertainty quantification techniques for design of emerging materials systems including microstructural materials, metamaterials and programmable materials. She serves as the Design Thrust lead for the NSF Engineering Research Center (ERC) on Hybrid Autonomous Manufacturing, Moving from Evolution to Revolution (HAMMER), where she works on digital twin systems for concurrent materials and manufacturing process design. Dr. Chen is an elected member of the National Academy of Engineering (NAE) and American Academy of Arts and Sciences (AAA&S). She served as the Editor-in-chief of the ASME Journal of Mechanical Design, the Chair of the ASME Design Engineering Division (DED), and the President of the International Society of Structural and Multidisciplinary Optimization (ISSMO). Dr. Chen is the recipient of the 2022 Engineering Science Medal from the Society of Engineering Science (SES), ASME Pi Tau Sigma Charles Russ Richards Memorial Award (2021), ASME Design Automation Award (2015), Intelligent Optimal Design Prize (2005), ASME Pi Tau Sigma Gold Medal achievement award (1998), and the NSF Faculty Career Award (1996). She received her Ph.D. from the Georgia Institute of Technology in 1995.

Abstract: The convergence of nanotechnology and artificial intelligence (Nano-AI) represents a transformative frontier in science and technology. This talk will highlight recent advancements, ongoing research, and future directions in Nano-AI, focusing on the opportunities and challenges in AI-driven materials discovery, autonomous materials experimentation, and digital twins for autonomous nano-manufacturing.

AI for materials discovery leverages machine learning algorithms to predict and design new materials with desired properties, significantly accelerating the discovery process. Autonomous materials experimentation enhances this process by using AI to control and optimize experimental setups, enabling high-throughput and precise investigations at the nanoscale. Furthermore, the complexity of manipulating materials at the nanoscale requires precise control and innovative fabrication techniques. Digital twin technology can play a key role in real-time monitoring, simulation, and control of nanoscale processes, enhancing both product and process quality.

This talk will highlight a wide range of Nano-AI applications that will lead to direct societal impacts in developing sustainable materials, eco-manufacturing, clean energy, and health. It will also emphasize the need for data sharing, interdisciplinary collaboration, and workforce development to overcome challenges and harness the full potential of this exciting convergence.