APS Scientific Computation Seminar Series

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Title: Deep Learning Based X-ray CT Reconstruction for Fast and High-Quality Characterization in Metal Additive Manufacturing Leveraging CAD Models and Physics-Based Information

Date: Monday, April 25, 2022

Time: 1:00 p.m. (Central Time)

Location: https://argonne.zoomgov.com/j/1615356746
Meeting ID: 161 535 6746
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Hosts: Mathew Cherukara and Nicholas Schwarz

Abstract: Metal Additive Manufacturing (AM), also known as 3D printing, is the process of printing 3D metal parts layer by layer based on corresponding computer aided design (CAD) models input to the printer. X-ray computed tomography (CT) has been used as the key tool for non-destructive characterization (NDC) of metal AM parts. In recent years, and along with the fourth industrial revolution (industry 4.0), there has been efforts for integrating the X-ray CT in-line with the printing process so that it can characterize several parts quickly and provide user with feedback on the quality of the printed parts. This in turn requires a faster X-ray CT scan either through sparse measurement, reducing the scan integration time per view, using less than full-scan data etc. Such requirement for X-ray CT scanning will introduce new challenges and artifacts to the existing challenges associated with X-ray CT scans of metal parts, such as noise, beam hardening and metal artifacts. In this talk, I will present our efforts in development of Deep Learning based Image Reconstruction algorithms leveraging CAD model of the parts along with the physics-based information to enhance the quality of X-ray CT reconstruction of metal AM parts, while reducing the scan time. I will also present case studies showing how this approach has resulted in fast process parameter optimization for novel materials in metal AM, as well as at least 3-4X improvement in flaw detection capability without compromising the scanning speed and discuss the future works.