Title:

Enhancing 3D reconstruction accuracy of multi-voltage FIB tomography images using multimodal machine learning

Keywords:

Multimodal machine learning, Multi-voltage images, FIB-SEM, Over deterministic systems, 3D reconstruction

Authors:

Sardhara, Trushal - 0000-0001-9915-3039

Institute for Continuum and Material Mechanics, Hamburg University of Technology, Hamburg, Germany

Shkurmanov, Alexander - 0000-0001-8751-0924

Electron Microscopy Unit, Hamburg University of Technology, Hamburg, Germany

Li, Yong - 0000-0003-1472-9567

Institute of Materials Physics and Technology, Hamburg University of Technology, Hamburg, Germany

Riedel, Lukas - NA

Institute of Materials Mechanics, Helmholtz-Zentrum Hereon, Geesthacht, Germany

Shi, Shan - 0000-0001-8510-4586

Research Group of Integrated Metallic Nanomaterials Systems, Hamburg University of Technology, Hamburg, Germany

Cyron, Christian J. - 0000-0001-8264-0885

Institute for Continuum and Material Mechanics, Hamburg University of Technology, Hamburg, Germany

Aydin, Roland C. - 0000-0002-9542-9146

Institute of Material Systems Modeling, Helmholtz-Zentrum Hereon, Geesthacht, Germany

Ritter, Martin - 0000-0002-5664-859X

Electron Microscopy Unit, Hamburg University of Technology, Hamburg, Germany

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Abstract of the paper:

FIB-SEM tomography is a powerful technique that integrates a focused ion beam (FIB) and a scanning electron microscope (SEM) to capture high-resolution imaging data of nanostructures. This approach involves collecting in-plane SEM images and utilizing FIB to remove material layers for imaging subsequent planes, thus creating image stacks. However, these image stacks in FIB-SEM tomography are subject to the *shine-through effect*, due to which structures become visible from posterior regions of the current plane. This contamination introduces an ambiguity between image intensity and structures in the current plane, making traditional segmentation methods like thresholding or the k-means algorithm insufficient. In this study, we propose a multimodal machine learning approach that combines intensity information from different accelerating voltages to improve the 3D reconstruction of nanostructures. By treating the increased *shine-through effect* at higher accelerating voltages as a form of *additional* information, our proposed method significantly improves segmentation accuracy and leads to more precise 3D reconstructions for real FIB tomography data.