Call for Papers
IEEE Signal Processing Society
IEEE SIGNAL PROCESSING MAGAZINE

Special Issue on Signal Processing for Advanced Materials

The development of new materials has been a hallmark of technological advancement since at least the Bronze Age, when copper and tin were alloyed to create tools that had properties favorable to those made from stone. For thousands of years, until the development of microscope imaging, new materials continued to be developed “blindly,” without any understanding of the effects of the structure at the micro- or nanoscale on the observable properties of a material. With the advent of sensing modalities such as electron microscopy and x-ray tomography, huge amounts of microstructural data of many different classes of materials have become available. However, the materials science field has only recently begun to explore the methods of modern data and imaging science provided by the field of signal processing. Where such methods have been applied, substantial leaps forward have been made in the design and development of advanced materials. There is a tremendous opportunity for further interdisciplinary work between the signal processing and materials science fields. This special issue aims to highlight both progress that has already been made and research areas where signal processing methods could revolutionize the field of materials development in the future.

To this end, this call seeks papers describing recent advances in the application of signal processing methods to materials characterization, as well as papers on current unsolved materials research problems for which signal processing expertise is needed. Some examples of topics include improved methods for sensing and reconstructing data at scales on the order of microns, nanometers, or even the atomic scale; analysis of materials image data, for the purposes of denoising, deblurring, segmentation, and feature extraction, for example; statistical modeling of microstructure of materials; and stochastic simulation of materials.

Topics of interest include (but are not limited to):

- Emerging sensor modalities for characterization
- Dynamic sampling for characterization
- Tomographic reconstruction of materials images
- Image denoising, deblurring, segmentation
- Physics-based forward modeling and regularization
- AI methods for modeling of materials
- Non-intrusive methods for regularization
- Stochastic simulation of materials structures
- Feature-based reconstruction for materials datasets
- Statistically rare materials phenomena
- Density estimation on data manifolds
- Topology of materials
- Phase retrieval
- Model fusion
- Data fusion for materials datasets
- Superresolution
- Uncertainty quantification
- Graphical methods for microstructures

White papers are required, and full articles are invited based on the review of white papers. Articles submitted must be of a tutorial and overview/survey nature and in accessible style to a broad audience. Submissions will be reviewed according to the IEEE Signal Processing Magazine guidelines, and should not have been published or under review elsewhere. Submissions should be made online at http://mc.manuscriptcentral.com/sps-ieee. For guidelines and information on paper submissions, visit http://www.signalprocessingsociety.org/publications/periodicals/spm/.

Important Dates

- White papers (4 pages) due: Dec 05, 2020
- Revised manuscripts due: August 05, 2021
- Invitation notification: February 05, 2021
- Final decision notification: September 05, 2021
- Full-length manuscripts due: May 05, 2021
- Final manuscripts due: October 5, 2021
- First reviews to authors: July 05, 2021
- Publication date: Mar 2022

Guest Editors

Mary L. Comer, Lead Guest Editor, Purdue University, West Lafayette, IN, USA, comerm@purdue.edu
Jeff Simmons, Air Force Research Laboratory, Dayton, OH, jeff.simmons.3@us.af.mil
Steve Niezgoda, The Ohio State University, Columbus, OH, niezgoda.6@osu.edu
Charles A. Bouman, Purdue University, West Lafayette, IN, USA, bouman@purdue.edu
Benjamin Berkels, RWTH Aachen University, Germany, berkels@aices.rwth-aachen.de