CHEMICAL ENGINEERING

SEMINAR SERIES

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Data science tools for the physics-based analysis of lithium-ion battery impedance spectra

ABSTRACT: Widespread access to extremely low-cost computing and data storage have revolutionized the way many scientific disciplines are asking questions and solving problems using statistical, data management, and visualization methods commonly referred to as "data science." This talk will describe a data science approach to improving the analysis of experimental impedance spectra through the statistical insight generated from physics-based battery models. We will describe our approach in creating and analyzing a large dataset of 38,800 simulated impedance spectra. A global sensitivity analysis across physically meaningful parameter ranges shows the factors most important to the model and can provide quantitative insight into the information content of our experimental measurements under different conditions. The importance of ChemE fundamentals (understanding of characteristic time/length scales, boundary layers, etc.) when applying data science methods will also be discussed. Lastly, we describe the use of the dataset for parameter estimation and the role of open-source tools for increasing the adoption of these models for the analysis of experimental data.

BIOGRAPHY: Matthew D. Murbach is a PhD candidate in the Electrochemical Materials and Interfaces lab in the Department of Chemical Engineering at the University of Washington (UW). Matt was an inaugural trainee in the Big Data and Data Science IGERT program and a Clean Energy Institute (CEI) graduate fellow. He was also the founding president of the Electrochemical Society (ECS) student chapter at UW and co-organized the first ECS Data Science Hack Day to create a community of electrochemical data scientists. In 2015, he co-founded Battery Informatics, Inc. (Bii) and serves as the Chief Technology Officer. Bii combines electrochemical engineering and data science to provide advanced analytics and battery management to customers looking to extract the maximum value from their energy storage assets. He was recently named to the Forbes' 30 Under 30 in Energy.

RECEPTION 3:30 • LECTURE 4:00 – 5:00
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