COLLEGE OF ENGINEERING
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Mechanical Engineering Seminar Series

Control of Interfacial Stability in Electrochemical Systems

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Professor

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2540 GG Brown

Abstract

Electrochemical interfaces often undergo instabilities in shape or composition, which are notoriously difficult to control in engineering applications. The first part of this talk will describe three types of moving interfaces – viscous fingers, deionization shocks, and metal dendrites – whose stability can be controlled by electrokinetic phenomena in charged porous media, with applications to electrically enhanced oil recovery, water purification by shock electrodialysis, and energy storage in metal batteries. The second part of the talk will describe how driven electrochemical reactions can alter the thermodynamic stability of solid or liquid interfaces, with applications to Li-ion batteries, electrodeposition, and biological patterns. Finally, I will describe how the physics of pattern formation (in these and other examples) can be learned directly from image data, by solving a PDE-constrained inverse problem.

Bio

Martin Z. Bazant is the E. G. Roos (1944) Professor of Chemical Engineering and Mathematics and Executive Officer of the Department of Chemical Engineering at the Massachusetts Institute of Technology. After a PhD in Physics at Harvard (1997), he joined the MIT faculty in Mathematics (1998) and then in Chemical Engineering (2008). He is a Fellow of the American Physical Society, the International Society of Electrochemistry, and the Royal Society of Chemistry, and winner of the 2015 Kuznetsov Prize in Theoretical Electrochemistry (ISE) and 2018 Andreas Acrivos Award for Professional Progress in Chemical Engineering (AIChE). He also serves as the Chief Scientific Advisor for Saint Gobain Ceramics and Plastics, North America.

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