

Computational Mathematics, Science and Engineering
Colleges of Engineering and Natural Science

Colloquium by Liliana Borcea

Peter Field Collegiate Professor of Mathematics
University of Michigan

March 21, 2016, 4:00 PM; C304 Wells Hall

“Analysis of electromagnetic waves in random media”

We study Maxwell's equations in media with small random fluctuations of the electric permittivity, to obtain a detailed mathematical characterization of the statistics of the electric and magnetic fields at long distances of propagation. We introduce a novel wide-angle wave propagation regime, which is mathematically justified by scaling assumptions. In this regime, we obtain a decomposition of the waves in transverse electric and magnetic modes with random amplitudes. These amplitudes account for the cumulative scattering effects in the medium, and satisfy a system of stochastic differential equations which can be analyzed with the Markov limit theorem. The result is an explicit quantification of the randomization of the waves due to scattering, an understanding of polarization effects, and a mathematical justification of the radiative transport equations with polarization.

Liliana Borcea studied physics at University of Bucharest, Romania, after which she obtained a PhD in Scientific Computing and Computational Mathematics at Stanford University, in 1996. She held the following academic positions: 2013-Present Peter Field Collegiate Professor of Mathematics, University of Michigan, Ann Arbor; 2007-2013 Noah Harding Professor of Computational and Applied Mathematics, Rice University; 2001-2007 Associate Professor of Computational and Applied Mathematics, Rice University; 1996-2001 Assistant Professor of Computational and Applied Mathematics, Rice University; 1996-1997 NSF Postdoctoral Fellow in Applied Mathematics, California Institute of Technology. She also held visiting positions at: Stanford University; MSRI Berkeley, IPAM UCLA, Ecole Normale Supérieure Paris, INRIA Roquencourt.

Her research interests are: stochastic methods with application to wave propagation and imaging in random media, and inverse problems.

She is on the editorial board of two SIAM Journals: Multiscale Modeling and Simulations and journal of Uncertainty Quantification; of the Journal Inverse Problems and of the Journal Inverse Problems and Imaging. She is presently on the SIAM Council and was the chair of the SIAM Imaging Sciences activity group in (2010-2011).

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