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APPLIED MATHEMATICS SEMINAR 291

Propagation and scattering of electromagnetic waves: time-domain transients, pure frequencies, and the Fourier transform

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Location: **COB1 265**

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ABSTRACT

Numerical Simulation of Propagation and Scattering of Electromagnetic Waves: time-domain transients, pure frequencies, and the Fourier transform.

After a brief review of classical numerical methods for the differential equations of physics and, in particular, electromagnetism, we will consider electromagnetic waves with harmonic temporal dependence (ie, "pure" radio waves, or light waves, or rays). X, etc.) We will use the fundamental solution of the harmonic electromagnetic problem to construct numerical solutions to problems involving highly complex electromagnetic structures. As an illustration of these ideas, we will present applications to the design and optimization of photonic devices (such as cameras, circuits, and optical fibers). We will also mention an intriguing observation, according to which it is possible to obtain in a very effective way the arbitrary temporal dependence (not necessarily harmonic) of the electromagnetic fields and other observables in physics on the basis of solutions with harmonic temporal dependence for a fixed set of frequencies of oscillation.

BIO:

Dr. Bruno received his Ph.D. degree from the Courant Institute of Mathematical Sciences, New York University. Following graduation, he held a two-year position as Visiting Assistant Professor with the University of Minnesota, and he then joined the faculty of the Georgia Institute of Technology (Georgia Tech), where he served as Assistant and Associate Professor. After a four-year period with Georgia Tech, in 1995 he joined the faculty of the California Institute of Technology (Caltech), where he has served as Professor in the Department of Applied and Computational Mathematics since 1998, and as Executive Officer of that department during 1998-2000. Dr. Bruno's research interests lie in areas of optics, elasticity and electromagnetism, remote sensing and radar, overall electromagnetic and elastic behavior of materials (solids, fluids, composites materials, multiple-scale geometries), and phase transitions. Dr. Bruno has directed 37 graduate students and postdocs during his career, and his research efforts have resulted in the publication of over 100 refereed articles, and have been acknowledged by his plenary presentations at a wide range of international conferences, his service on editorial boards of important scientific journals, including the SIAM Journal of Applied Mathematics, the SIAM Journal on Scientific Computing, and the Proceedings of the Royal Society of London, and his election to honorary societies, most notably the Council for the Society for Industrial and Applied Mathematics. Dr. Bruno is a recipient of the Sigma-Xi faculty award, the Friedrichs Award for an outstanding dissertation in mathematics, a Young Investigator Award from the National Science Foundation. and a Sloan Foundation Fellowship. Dr. Bruno is a SIAM Fellow, in the class of 2013, and a National Security NSSEFF Vannevar Bush fellow, in the class of 2016.