TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

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Computational Challenges of Homogenization

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Abstract.

Anisotropy and inhomogeneity pose very different computational challenges in front propagation and optimal control problems. (E.g., how long will it take for a forest fire to reach a certain location? Given different/mixed types of trees present in that forest? In the presence of strong winds? Taking into account the varied forest landscape? etc...) The idea of "homogenization" can be introduced informally as a practical approach for dealing with periodic or random inhomogeneity, particularly in problems with a strong separation of scales.

I will highlight the computational challenges and the key ideas in 2-scale and 3-scale computations of geometric optics. This will be based on an efficient homogenization of first-order Hamilton-Jacobi PDEs. I will illustrate the approach with the effective velocity profiles for a number of periodic and "random" composite materials with 2D and 3D micro-geometries. The first part is based on joint work with A. Oberman and R. Takei; the newer experimental results in 3D were obtained with A. Chacon.