



Universidad  
Carlos III de Madrid

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## Convergent Power Series for Waves in Periodic Metamaterials

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### Abstract

Fields in sub-wavelength periodic composite materials are typically expanded in formal power series, with the variable of expansion being the ratio of cell size to wavelength. These series are typically only formal, or, at best, asymptotic. But for Bloch waves in infinite periodic media with high contrast, we prove that they are actually convergent. We foresee utilizing the method of convergent power series as a rigorous framework for the analysis of the role of higher-order multipoles in the creation of certain curious bulk properties of metamaterials that have been observed in numerical simulations. To this end, one must obtain a quantitative lower bound on the radius of convergence of the series, and this presents one of the major challenges. I will begin by describing foundational work of H. Schwarz, in which he used convergent power series to devise the first general proof of the existence of a Dirichlet eigenvalue, and then point out the difficulties presented in the context of metamaterials.

Joint work with R. Lipton and S. Fortes, Department of Mathematics, Louisiana State University, USA.

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