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Bloch-mode analysis for unambiguous retrieval of metamaterial effective parameters

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We propose a method for retrieval of effective parameters of metamaterials based on the Bloch-mode analysis of periodic composite structures. We employ both surface and volume averaging of the electromagnetic fields of the dominating (fundamental) Bloch mode to determine the Bloch and wave impedances, respectively. We discuss how this method works for several characteristic examples and demonstrate that this approach can be useful to unambiguously determine both the material and wave effective parameters of lossy and lossless metamaterials with local response.

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