Numerical Simulation of Periodic Structure Problems

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Abstract: In order to numerically solve periodic structure problems (like photonic crystals (PC) structures, meta materials, etc.) efficiently one usually confines the spatial domain to a bounded computational domain (in a neighborhood of the region of physical interest).
The usual strategy is to introduce so-called artificial boundaries and impose adequate boundary conditions [1]. For wave-like equations, the ideal boundary conditions should not only lead to well-posed problems, but also mimic the perfect absorption of waves traveling out of the computational domain through the artificial boundaries.
We will review results of a series of papers [2,3,4] on solving partial differential equations (PDEs) with periodic coefficients and/or periodic geometries and present a novel analytical impedance expression for general second order ODE problems with periodic coefficients and a new numerical technique containing a fast evaluation of the Robin-to-Robin operator for periodic array problems.

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