

Wave propagation in periodic waveguides : limiting
absorption principle, behavior at infinity and
radiation conditions.

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We consider in this work the classical question of solving the scalar Helmholtz equation in a periodic waveguide in dimension $d + 1$, infinite in 1 dimension and bounded in the other d transverse directions. Both the geometry of the domain and the coefficients in the equation are allowed to vary periodically in the infinite direction. We establish the existence of an outgoing solution for the corresponding source problem by the standard limiting absorption process. We study the behavior at infinity of this solution, from which we deduce a radiation condition at infinity allowing us to prove corresponding uniqueness results. The analysis combines the use of the Floquet-Bloch transform, the perturbation theory for analytic families of operators and complex variable techniques.