An example of a phase transition in a periodic tubular structure

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Abstract

We consider an ε-periodic ($\varepsilon \to 0$) tubular structure, modelled as a magnetic Laplacian on a metric graph, which is periodic along a single axis. We show that the corresponding Hamiltonian admits norm-resolvent convergence to an ODE on $\mathbb{R}$ which is fourth-order in vicinity of a discrete set of values of the magnetic potential and second-order generically. The rate of convergence is also estimated. This represents a physically viable model of a phase transition as the strength of the (constant) magnetic field increases.