EFFECTS OF A NONTRIVIAL VERTEX COUPLING IN THE SPECTRA OF QUANTUM GRAPHS

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Abstract. Dealing with spectral analysis of Schrödinger operators on metric graphs, people usually assume the simplest vertex coupling, often called Kirchhoff. This is, however, only one of many possibilities, some of which have a reasonable physical motivation. The aim of the talk is to present several examples illustrating that such choices can lead to interesting spectral effects. One concerns the number of open spectral gaps; we will show that graphs with a nontrivial δ coupling can have finite but nonzero number of them. Furthermore, motivated by recent attempts to model the anomalous Hall effect, we investigate a class of vertex couplings that violate the time reversal invariance. For the simplest coupling of this type we show that its high-energy properties depend on the parity of the lattice vertices, and discuss consequences of this property. Finally, we will show that quantum graph operators can exhibit a nontrivial PT-symmetry even when they are self-adjoint.

The results stem from joint work with Marzieh Baradaran, Jiří Lipovský, Miloš Tater, Ondřej Turek, and Daniel Vašata.