Approximation of quantum graph vertex couplings by scaled Schrödinger operators on thin branched manifolds

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Abstract: We discuss approximations of vertex couplings of quantum graphs using families of thin branched manifolds. We show that if a Neumann type Laplacian on such manifolds is amended by suitable potentials, the resulting Schrdinger operators can approximate non-trivial vertex couplings. The latter include not only the delta-couplings but also those with wavefunctions discontinuous at the vertex. We work out the example of the symmetric delta'-couplings and conjecture that the same method can be applied to all couplings invariant with respect to the time reversal.