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Homotopies of eigenfunctions, and the spectrum of the Laplacian on the Sierpinski carpet. Preliminary report.

Consider a family of bounded domains Ω_t in the plane (or more generally any Euclidean space) that depend analytically on the parameter t, and consider the ordinary Neumann Laplacian Δ_t on each of them. Then we can organize all the eigenfunctions into continuous families $u_t^{(j)}$ with eigenvalues $\lambda_t^{(j)}$ also varying continuously with t, although the relative sizes of the eigenvalues will change with t at crossings where $\lambda_t^{(j)} = \lambda_t^{(k)}$. We call these families homotopies of eigenfunctions. We study two explicit examples. The first example has Ω_0 equal to a square and Ω_1 equal to a circle; in both cases the eigenfunctions are known explicitly, so our homotopies connect these two explicit families. In the second example we approximate the Sierpinski carpet starting with a square, and we continuously delete subsquares of varying sizes. (Received August 18, 2008)