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The Schiffer problem on the cylinder and on the 2-sphere

I will discuss a new result on the existence of a family of compact subdomains of the flat cylinder for which the Neumann eigenvalue problem for the Laplacian admits eigenfunctions with constant Dirichlet values on the boundary. These domains have the property that their boundaries have nonconstant principal curvatures. In the context of ambient Riemannian manifolds, our construction provides the first examples of such domains whose boundaries are neither homogeneous nor isoparametric hypersurfaces. The underlying functional analytic approach we have developed overcomes an inherent loss of regularity of the problem in standard function spaces. With the help of this approach, we also construct a related family of subdomains of the 2-sphere. By this we disprove a conjecture of Souam from 2005.

This is joint work with M.M. Fall and I.A. Minlend.