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**Pavel Grinfeld\*** ([pg@freeboundaries.com](mailto:pg@freeboundaries.com)), Department of Mathematics, Drexel University, Philadelphia, PA, PA 19105, and **Gilbert Strang** ([gs@math.mit.edu](mailto:gs@math.mit.edu)), Department of Mathematics, MIT, Cambridge, MA 02139. *Moving Interfaces in Spectral Problems: Laplace Eigenvalues on Polygons and Deformed Manifolds.*

The three essential elements of a boundary-value problem are the differential operator, the shape of the domain, and the boundary conditions. Our primary interest is shape. We discuss the change in Laplace eigenvalues induced by the perturbation of the boundary. We concentrate on regular polygons with  $N$  sides and present the first few terms in a series for the eigenvalues in powers of  $1/N$ . The series involves the Riemann zeta function and has other interesting properties. We also discuss out-of-plane deformations of manifolds and draw a connection to the dynamics of fluid films. (Received March 03, 2009)