Spectrum/Spectral Analysis = the Eigenvalues

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The shape of a standing wave in a string fixed at its boundaries is an example of an eigenfunction of a differential operator. The admissible eigenvalues are governed by the length of the string and determine the frequency of oscillation. [Wikipedia]

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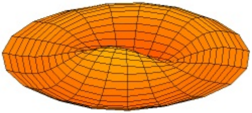
Ex 2: Spectrum of the Laplace operator

$\hat{O} = -\Delta$: Laplace operator (divergence of gradient)



This solution of the vibrating drum problem is, at any point in time, an eigenfunction of the Laplace operator on a disk [Wikipedia]

$$\vec{x} \rightarrow A\vec{x} = \lambda\vec{x}$$

vector → linear transformation of vector = scalar $\times$ eigenvector

$$f(x) \rightarrow \hat{O}f(x) = \lambda f(x)$$

function → linear operator on function = scalar $\times$ eigenfunction

- Engineering: If frequency of the wind too close to the natural frequency of a bridge—oscillations.
- Linearized model: eigenvalue of smallest magnitude
- Tacoma Narrows Bridge collapse in 1940
- Design of car stereo systems to reduce vibration of the car due to music.

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