Metric Optimization in Spectral geometry

Édouard Oudet

Université Grenoble Alpes

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The results of this talk have been obtained in collaboration with Chiu-Yen Kao and Braxton Osting.

The first part of the talk is dedicated to Nash's isometric embedding theorem for surfaces. We recall the impressive results obtained by HEVEA's project for the flat torus (V. Borrelli, F. Lazarus, B. Thibert et al.) and illustrate how spectral formulation may lead to a new intrinsic numerical approach which are not related to Gromov's construction.

Following the theoretical results of Fraser and Schoen, we describe in a second part a numerical process to approximate minimal surfaces in the ball. That is surfaces

1. contained in the ball

2. that have zero mean curvature and

3. meet the boundary of the ball orthogonally.

For genus $\gamma = 0$ and $b = 2, \cdots, 9, 12, 15, 20$ boundary components, we numerically solve the extremal Steklov problem for the first eigenvalue. The corresponding eigenfunctions generate a free boundary minimal surface, which have not been observed previously.