ON THE GLOBAL OPTIMALITY OF THE REGULAR PENTAGON FOR THE DIRICHLET EIGENVALUE PROBLEM

SEBASTIAN DOMINGUEZ, NILIMA NIGAM, AND BOBAK SHAHRIARI

Abstract. In this paper, we present a novel numerical strategy to study the Szegö-Pólya conjecture on 5-gons which states that the minimizer of the first Dirichlet eigenvalue over all 5-gons of given area is the regular pentagon. This conjecture is still open. We will describe known results on this conjecture. We will then describe a novel coupled Bayesian optimization and Finite Element method (via conforming and non-conforming piecewise linear functions) to study this problem. Finally, we will provide several results.

Keywords: Szegö-Pólya conjecture, first Dirichlet eigenvalue, Bayesian optimization, Finite element method.

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References

[1] E. Brochu, V. M. Cora and N. de Freitas. A Tutorial on Bayesian Optimization of Expensive Cost Functions, with Application to Active User Modeling and Hierarchical Reinforcement Learning. arXiv:1012.2599.

[2] C. Carstensen and J. Gedicke. Guaranteed lower bounds for eigenvalues. *Mathematics of Computation*, Volume 83, pp. 2605-2629, 2014.

[3] G. Pólya and G Szegö. Isoperametric inequalities in mathematical physics. *Princeton University Press*, 1951.

Department of Mathematics, Simon Fraser University, Burnaby, Canada
E-mail address: domingue@sfu.ca

Department of Mathematics, Simon Fraser University, Burnaby, Canada
E-mail address: nilima@math.sfu.ca

Department of Computer Science, University of British Columbia, Vancouver, Canada
E-mail address: bshahr@cs.ubc.ca