Gilbert, Alexander D.; Graham, Ivan G.; Scheichl, Robert; Sloan, Ian H.
Bounding the spectral gap for an elliptic eigenvalue problem with uniformly bounded stochastic coefficients. (English) Zbl 1452.65315

Summary: A key quantity that occurs in the error analysis of several numerical methods for eigenvalue problems is the distance between the eigenvalue of interest and the next nearest eigenvalue. When we are interested in the smallest or fundamental eigenvalue, we call this the spectral or fundamental gap. In a recent manuscript [A. D. Gilbert et al., Numer. Math. 142, No. 4, 863–915 (2019; Zbl 1416.65018), arXiv: 1808.02639], the current authors, together with Frances Kuo, studied an elliptic eigenvalue problem with homogeneous Dirichlet boundary conditions, and with coefficients that depend on an infinite number of uniformly distributed stochastic parameters. In this setting, the eigen-values, and in turn the eigenvalue gap, also depend on the stochastic parameters. Hence, for a robust error analysis one needs to be able to bound the gap over all possible realisations of the parameters, and because the gap depends on infinitely-many random parameters, this is not trivial. This short note presents, in a simplified setting, an important result that was shown in the paper above. Namely, that, under certain decay assumptions on the coefficient, the spectral gap of such a random elliptic eigenvalue problem can be bounded away from 0, uniformly over the entire infinite-dimensional parameter space.

For the entire collection see [Zbl 1445.37004].

MSC:
65N25 Numerical methods for eigenvalue problems for boundary value problems involving PDEs
65N15 Error bounds for boundary value problems involving PDEs
35R60 PDEs with randomness, stochastic partial differential equations
35P15 Estimates of eigenvalues in context of PDEs

Keywords:
elliptic eigenvalue problem; spectral gap

Full Text: DOI arXiv

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