
Spectral analysis of the diffusion operator with random jumps from the boundary

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Abstract

Using an operator-theoretic framework in a Hilbert-space setting, we perform a detailed spectral analysis of the one-dimensional Laplacian in a bounded interval, subject to specific non-self-adjoint connected boundary conditions modelling a random jump from the boundary to a point inside the interval.

In accordance with previous works, we find that all the eigenvalues are real.

As the new results, we derive and analyse the adjoint operator, determine the geometric and algebraic multiplicities of the eigenvalues, write down formulae for the eigenfunctions together with the generalised eigenfunctions and study their basis properties.

It turns out that the latter heavily depend on whether the distance of the interior point to the centre of the interval divided by the length of the interval is rational or irrational.

Finally, we find a closed formula for the metric operator that provides a similarity transform of the problem to a self-adjoint operator.

This is joint work with Martin Kolb.

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