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Metric and domain perturbation theory for the degenerate Grushin operator

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Resumo

We consider the eigenvalue problem with Dirichlet and Neumann boundary conditions for the elliptic operator in divergence form $L_{T,g,\eta}f = \operatorname{div}_\eta(T\nabla f) = \operatorname{div}_g(T\nabla f) - g(\nabla\eta, T\nabla f)$ on a compact Riemannian manifold M with boundary. We prove that the symmetric functions of the eigenvalues depend real analytically upon metric perturbations and we prove a Hadamard-type formula for their shape differential. The applications are dedicated to analyzing the critical points of the symmetric eigenvalue functions restricted to the space of metrics with constant volume, the characterization of the critical points of the symmetric eigenvalue functions of the operator $L_{T,g,\eta}$ parameterized by bounded domains in a Riemannian manifold and addressing the geometric optimization problem of the first non-zero eigenvalue μ_2 for the operator $L_{T,g,\eta}$ with Neumann boundary conditions on bounded subdomains Ω of a Riemannian manifold (M, g) .

Keywords:: Degenerate elliptic operators; Spectral theorem; Metric perturbation; Hadamard formula.

REFERÊNCIAS

CUNHA, C. L.; GOMES, J. N.; MARROCOS, M. A. M. Hadamard type variation formulas for the eigenvalues of a class of second-order elliptic operators and its applications. *arXiv preprint arXiv:2306.06504*, 2023.

FALL, M. M.; WETH, T. Critical domains for the first nonzero neumann eigenvalue in riemannian manifolds. *Journal of Geometric Analysis*, v. 29, n. 4, p. 3221–3247, 2019.

LAMBERTI, P. D.; LUZZINI, P.; MUSOLINO, P. Shape perturbation of grushin eigenvalues. *Journal of Geometric Analysis*, p. 10679–10717, 2021.

Apoio:

