The number of Dirac-weighted eigenvalues of Sturm-Liouville equations with integrable potentials and an application to inverse problems

Xiao Chen[1] and Jiangang Qi[1]

[1]Shandong University at Weihai

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Abstract

In this paper, we further Meirong Zhang, et al.'s work by computing the number of weighted eigenvalues for Sturm-Liouville equations, equipped with general integrable potentials and Dirac weights, under Dirichlet boundary condition. We show that, for a Sturm-Liouville equation with a general integrable potential, if its weight is a positive linear combination of n Dirac Delta functions, then it has at most n (may be less than n, or even be 0) distinct real Dirichlet eigenvalues, or every complex number is a Dirichlet eigenvalue; in particular, under some sharp condition, the number of Dirichlet eigenvalues is exactly n. Our main method is to introduce the concepts of characteristics matrix and characteristics polynomial for Sturm-Liouville problem with Dirac weights, and put forward a general and direct algorithm used for computing eigenvalues. As an application, a class of inverse Dirichelt problems for Sturm-Liouville equations involving single Dirac distribution weights is studied.

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