

CONSTRUCTION OF TRANSMUTATIONS AND APPLICATIONS TO SPECTRAL PROBLEMS

Vladislav V. Kravchenko

Department of Mathematics, Center for Research and Advanced
Studies of the National Polytechnic Institute, Campus Queretaro,
Mexico

vkravchenko@math.cinvestav.edu.mx

In the talk several new results concerning properties and construction of the transmutation (transformation) operator [1] relating the one-dimensional Schrödinger operator with the second derivative are presented. In particular, an exact representation for the integral transmutation kernel in the form of a Fourier-Legendre series with explicit formulas for the coefficients is obtained [2]. As a corollary, a new representation for solutions of the Sturm-Liouville equation is derived. For every x the solution is represented as a Neumann series of Bessel functions depending on the spectral parameter ω . Due to the fact that the representation is obtained using the corresponding transmutation operator, a partial sum of the series approximates the solution uniformly with respect to ω which makes it especially convenient for the approximate solution of spectral problems. The numerical method based on the proposed approach allows one to compute large sets of eigendata with a nondeteriorating accuracy. Similar results are valid for perturbed Bessel equations.

Additionally other applications of the main result are discussed such as construction of complete systems of solutions of partial differential equations including the extension of the method of fundamental solutions onto the PDEs with variable coefficients.

[1] *V. A. Marchenko*, Sturm-Liouville Operators and Applications. Birkhäuser, Basel, 1986.

[2] *V. V. Kravchenko, L. J. Navarro and S. M. Torba*, Representation of solutions to the one-dimensional Schrödinger equation in terms of Neumann series of Bessel functions. Submitted for publication, available at arxiv:1508.02738.