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Neutron Spectra Unfolding by the Trial Function Expansion Method from the Readings of a Finite Number of Bonner Spectrometers

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Reconstruction of neutron spectra over a wide energy range from 10^{-8} to 10^{3} MeV is very relevant for the purposes of ensuring radiation safety behind biological shields at high-energy accelerators and reactors. A Bonner multi-sphere spectrometer is used for measurements. However, to unfold the entire spectrum from the measurement data, it is necessary to solve the Fredholm integral equation of the first kind. From the point of view of mathematics it is an inverse problem and it belongs to the class of ill-posed problems. In our work, we propose a numerical method for reconstructing neutron spectra based on a modified approach using their expansion either in terms of detector sensitivity functions or in terms of shifted Legendre polynomials. This approach is based on Tikhonov's regularization method, which is usually used to solve the system of linear equations obtained as a result of discretization of the system of integral equations under grid representation. Based on a proposed approach a computer code was developed. Neutron Spectra were unfolded for several locations at the JINR accelerators and reactor and compared with the spectra unfolded by statistical regularization code.

Summary

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