

STUDY OF TIKHONOV REGULARIZATION IN SPECTRA RECONSTRUCTION

Friday, 15 July 2022 13:10 (20 minutes)

The electron energy spectrum is one of the important parameters in electron beam radiation treatment planning for accurate calculation of the dose-volume distribution of the irradiated object. Existing methods such as Monte-Carlo modeling of the radiation source and radiation geometry and direct measurement of the energy spectrum using special equipment are time consuming and expensive, respectively. The most universal method is the indirect method based on the reconstruction electron beam spectrum from experimentally measured data.

In this work, the authors reconstructed electron energy spectra from the depth dose distributions in aluminum using the standard least squares method, supplemented with Tikhonov's regularization. As the reference spectra for estimating the reconstruction accuracy the spectra of the UELR-10-15S accelerator for four different operating modes with maximum energies of 5 MeV, 6.5 MeV, 8 MeV, and 10 MeV have been selected.

The aim of the work was to study the influence of different types of Tikhonov regularization parameters calculated with the absolute and relative correction methods, the quasi-optimal method and the residual method [1-3], on the accuracy of reconstructing the electron beam spectra from the depth dose distributions in aluminum.

The accuracy of reconstructed with Tikhonov's regularization the electron spectra from depth dose distributions was established depending on the choice of the regularization parameter, as well as the energy mode of the accelerator and the experimental error in measuring depth dose distributions.

It was found that the error in the reconstruction of the spectra in the case of the regularization parameter calculated with the residual method is on average 10% lower compared to other methods.

It was also shown that the accuracy of the reconstruction of depth dose distributions from the reconstructed energy spectra is about 85–95%, depending on the maximum energy of the electron beam of the accelerator and the choice of the regularization parameter.

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The speaker is a student or young scientist

Yes

Section

1. Nuclear technology and methods in medicine, radioecology

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Session Classification: Nuclear technology and methods in medicine, radioecology.