INTENSITY-MODULATED ELECTRON BEAM TREATMENT SIMULATION METHODS

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The paper investigates the methods of simulating an electron beam for modulated electron radiotherapy (MERT). MERT is a kind of intensity-modulated radiation therapy (IMRT), which uses the electron beam as a required dose source. IMRT is an advanced mode of high-precision radiotherapy that uses particle accelerators to deliver precise radiation doses to a malignant tumor or specific areas within the tumor [1]. Currently, IMRT is being used most extensively to treat cancers of the prostate, head and neck, and central nervous system. IMRT has also been used in limited situations to treat breast, thyroid, lung, as well as in gastrointestinal, gynecologic malignancies and certain types of sarcomas. IMRT can also be beneficial for treating pediatric malignancies.

Beam simulation is the one of the main parts of the radiation treatment planning. It is divided into two parts: simulation of dose distribution in patient's tissues and simulation of beam shape and intensity [2].

The following methods for dose calculation and beam characteristics are described in this paper:

- Pencil Beam based on Fermi-Eyges transport theory;
- Convolution/Superposition method based on the convolution operation;
- Algorithms based on the Monte Carlo method, which are the most common nowadays.

Thereby, Monte Carlo algorithms are considered in comparison to other methods of electron beam treatment simulation.

REFERENCES

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ПОСТРОЕНИЕ МАТЕМАТИЧЕСКОЙ МОДЕЛИ ОЦЕНКИ ЗАТРАТ ЭЛЕКТРОЭНЕРГИИ МЕТОДОМ СИНГУЛЯРНОГО АНАЛИЗА

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Рассмотрим решение следующей задачи идентификации [1]:

$$K\varphi = f, \qquad (1)$$

где матрица K размером $n \times m$ представляет собой выпуск продукции различного вида за период с 4 февраля по 31 декабрь 2015 года, вектор f размерности n – мощность, потребляемая предприятием за сутки. Требуется найти вектор φ размерности n, показывающий, какая мощность требуется для производства одной тонны продукции товара определенного вида за сутки.

Используя определение сингулярного разложения прямоугольный матрицы K, вычислим ее число обусловленности. Матрицу K представляется в виде: