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VISUALIZATION OF MONTE-CARLO SIMULATION FOR THE ELLIPSOIDAL BIOMETRIC SYSTEM

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This paper describes algorithm of visualization of Monte-Carlo simulation for the process of distribution optical radiation in biometric system «multi-layered biological tissue (BT) + ellipsoidal reflector (ER)».

Analytical core of the system [1], which based on the laws of physical optics, uses direct Monte-Carlo method, which based on random numbers generation, for modelling interaction of optical radiation with absorption and scattering centers within BT. In this way goes determining of the coordinates of the photon and its energy value after each act of interaction with the environment. Using arrays of parameters, obtained for a BT sample with such an optical properties as thickness, refractive index, absorption coefficient, scattering coefficient and factor anisotropy for each layer performing visualization of Monte-Carlo simulation.

Coordinates of photons, that escaped from the environment in forward and backscattered directions, and their energy value allows simulate the work process of photometric system with ER [2]. Herewith, ellipsoidal reflectors was made in the form of prolate and truncated at the focal plane ellipsoid of revolution, which collects response of investigated biological environment in the form of spot of scattered optical radiation and forms an image of the external layers of tissue that had interacted with radiation. Process of simulation consists in calculation of coordinates of the intersection point of the ray that came from BT with the surface of the reflector, and coordinates of intersection point of the reflected from the ellipsoid surface beam with the second focal plane. The results of the simulation are the ZX and ZY reflector views, as well as the XY view in the focal planes.

In the work are represented modelling result, to wit the view of tissue, views of ellipsoidal reflector and it focal planes, for BT with different set of optical parameters.

Adaptation of Monte-Carlo simulation, which uses an infinitely narrow beam of photons, to the real profile of the laser emitter (usually Gaussian), will allow to compare the model results with real experiment.

References

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