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Phd thesis

Multispectral Endoscopic Imaging in Photodynamic Diagnosis by Monte Carlo Simulation of Light Propagation in Human Tissue

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Summary

Photodynamic diagnosis is basing on the fluorescence phenomenon, where special substances are collected in cancerous cells and under appropriate illumination can be recognized by domination of red color in reflected spectra. As the result of performed investigations, it was possible to create a mathematical model of subsurface light transport of chosen human tissue, defined by absorption, scattering and fluorescence. Thanks to computer simulation utilizing Monte Carlo method, different multi-spectral images were generated qualitatively compliant with real multi-spectral images taken during photodynamic diagnosis. The validity between images generated during simulation and real multispectral images enabled a more detailed analysis of data acquisition process from the point of view of simplification and optimization. For this reason the influence of such parameters like light incident angle, the light source spectrum or the distance to the investigated tissue surface was investigated very deeply. Together with multispectral image processing methods (like e.g. *Orthogonal Subspace Projection*) it was possible to speed up the preparation of photodynamic diagnosis and unambiguously distinguish between cancerous and healthy tissue. The proposed model of human skin tissue allows to better understand phenomenons occurring under the tissue surface and optimize the process of photodynamic diagnosis with no engagement of medical experts, patients and expensive devices.