

On-line Monte Carlo tool for the needs of Biomedical optics and Biophotonics

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The tutorial aims at introducing the basics of light-tissue interaction, and the influence of tissue optical properties on the signal formation in major optical modalities used in skin diagnosis. The basics of tissue optical properties will be reviewed in order to appreciate the parameters used for the modelling and its physical origin. The theoretical framework is based on the radiative transfer principles and the known exact analytic solution of wave propagation in random media. The choice of phase function will be discussed. Comparison to numerical simulations of human skin spectra and skin colour with the experimental data will be presented. A range of probing conditions for screening the complex composite structure of skin and detection the optical signal affected by structural or physiological changes will be considered. Finally, the online Monte Carlo tool, specially developed for imitation of optical radiation propagation within complex multi-layered tissue-like media will be introduced. The current version provides access to simulation of detector depth sensitivity (sampling volume) for a range of probes typically used in reflectance-based measurements, reflectance spectra of human skin and/or multi-layered scattering structures, and skin-colour modelling. The tool allows users to customize the parameters of the medium, probe, and observation area. In addition the particular applications of the computational tool, including fluence rate distribution, OCT images, laser pulse propagation, and coherent polarized light, will be considered.