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Numerical simulation of Raman scattering in biological tissues

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The quantitative analysis of Raman spectroscopic signals in biological tissue is generally difficult. Typical samples contain a multitude of molecular species and, in addition, measurements altered by attenuation of the Raman signal. Realistic numerical modeling of the Raman process can help to facilitate the quantitative analysis of the Raman spectra, but approaches so far are scarce and often time-consuming. In this work, we report on two different and very efficient approaches for modeling of Raman scattering in turbid media irradiated by laser light. Both approaches utilize the Monte Carlo method to simulate the Raman scattering process. We compare the efficiency of both approaches and discuss possible future extensions and experimental validation. Most of simulations of Raman scattering use a two-step model, calculating the distribution of the incident radiation first and then re-launching Raman scattered photons based on this distribution. The reason for this approach is the fact that Raman scattering is a very weak process. Raman cross sections expected to be 10 orders of magnitude smaller than the quantum yields of fluorescence. The number of Raman photons or the weight of the Raman photon packages is extremely low after the Raman scattering event. The goal of this work is to provide a comparative evaluation of the two approaches for weaker processes such as conventional or resonance Raman scattering. In order to decide which model to use for a particular Raman application (normal, resonance, surface-enhanced, etc.), it is important to understand how these assumptions affect the numerical results obtained from the simulation.

Biography

A Seteikin has studied Physics at the Pedagogical University in Blagoveshchensk. He has received his PhD in Physics in 2000. Currently, he is a Professor in the Department of Physics at the Amur State University in Blagoveshchensk. His scientific background is in the field of Laser - Tissue Interaction and Biophysics. In his work, he uses experimental and computational techniques. He has national and international collaborations in Physical and Life Science research.

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