

Abstract

Determine the optical properties of biological tissue is an important issue in medical applications. There are many theoretical methods to measure tissue optical properties. These theoretical methods can be applied by knowing number of experimental quantities, but, there are no ensure information about the most accurate method.

In our research, we introduce three different methods to determine the optical properties of biological tissue: Kubelka Munk (KM) model, Three Dimension Diffusion Approximation (TDDA) and Inverse Heat Transfer Problem (IHTP). The results of these methods are compared with others methods. In KM the optical properties are determined and the best percentage error we got was 0% and the highest one was 19%. In three dimensions diffusion approximation diffuse reflection and transmission are determined.

The results of TDDA were disagreement and it need re-evaluation comparing with the other methods. A New methodology (IHTP) has been proposed to measure tissue optical properties. A laser beam is used to induce heat to the tissue, then it was measured using thermocouple. By comparing these readings with that measured using the Finite element method. Tissue optical properties were determined using Levenberg-Marquardt iteration. An accurate result is obtained in determining the optical properties (0.989% for μ_a and 3.6 % for μ_s). The only limitation is that the temperature readings have to be measured with high accuracy (i.e. by using thermocouple with error less than 0.4%).