

On the Domain Derivative in a Radiative Transfer Problem

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In single photon emission computed tomography (SPECT) and bioluminescence tomography (BLT) the location as well as the radiation intensity of a photon source (marked cell clusters) inside an organism have to be determined given the outside photon count. The propagation of photons in animal tissue is accurately described by the radiative transfer equation (RTE). So SPECT and BLT are inverse source problems based on the RTE. It is well-known that both problems are ill-posed. In many applications the source can be assumed to be a linear combination of indicator functions leading to a nonlinear operator equation. The crucial point in solving this operator equation is to calculate the derivative of the forward operator with respect to the geometric variable, the so-called domain derivative. In the talk a rigorous derivation of the domain derivative is presented for a class of domains.