NEW DEVELOPMENTS IN FREQUENCY DOMAIN OPTICAL TOMOGRAPHY. PART I. FORWARD MODEL AND GRADIENT COMPUTATION

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ABSTRACT. This paper deals with a gradient-based frequency domain optical tomography method where the collimated source direction is taken into account in the computation of both the forward and the adjoint models. The forward model is based on the least square finite element method associated to the discrete ordinates method where no empirical stabilization is needed. In this first part of the study, the forward model is highlighted with an easy handling of complex boundary condition through a penalization method. Gradient computation from an adjoint method is developed rigorously in a continuous manner through a Lagrangian formalism for the deduction of the adjoint equation and the gradient of the objective function. The proposed formulation can be easily generalized to stationary and time domain optical tomography by keeping the same expressions.