Level-set based shape optimization approach for the inverse optical tomography problem

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Abstract

We consider the inverse problem of recovering piecewise scattering and piecewise absorption jump sets from boundary measurements and from a single measurement of the absorbed energy. We pro- pose a reconstruction method based on a shape optimization approach combined with the level set techniques. Our main result includes the partial shape derivatives of two different shape functionals, using differentiability properties of the min-sup combined with a function space parameterization technique. In particular it reveals the expression of the distributed partial shape derivative in tensor form. Based on the computed distributed partial shape derivatives, we introduce and implement a numerical approach based on the gradient approach and level set method. We present several numerical experiments to show the efficiency of the method both for exact reconstruction data and for realistic data with noise.