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Optimality of Pulse Energy for Photoacoustic Tomography

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Photoacoustic tomography (PAT) is a rapidly evolving imaging technique that combines the high contrast of optical imaging with the high resolution of ultrasound imaging. When dealing with typically noisy measurement data, one aims to identify certain parameters in the governing PDEs for the photoacoustic tomography system. Therefore, an essential factor in estimating these parameters is the system's design, which typically involves multiple factors that can affect the accuracy of reconstruction. In this work, we employ a Bayesian approach to solving a PAT inverse problem with the goal of optimizing the laser pulse of the PAT system to minimize the uncertainty in the reconstructed parameters. Additionally, we account for wave propagation attenuation in the inverse problem of PAT, which is governed by a fractionally damped wave equation. Finally, we illustrate the effectiveness of our proposed method using a numerical simulation.

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