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Topological derivative based Bayesian inference for inverse scattering problems

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Inverse scattering techniques seek to infer the structure of objects integrated in an ambient medium from data recorded at a set of receptors, which represent some scattered incident radiation. Solving the inverse problem amounts to finding objects minimizing the difference between the synthetic data generated by the approximate objects as predicted by a forward model and the true data. When the magnitude of the noise in the data is small, algorithms combining iteratively regularized Gauss-Newton schemes with topological derivative based initial guesses and updates of the number of objects may provide reasonable reconstructions [2]. However, estimating uncertainties inherent to this process as the magnitude of the noise increases is a challenging task. We propose a topological derivative based Bayesian inference framework [1]. Numerical simulations illustrate the resulting predictions in light and acoustic holography set-ups [1, 2, 3, 4, 5].

References

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