Non-parametric Phase Retrieval: Iterative transform algorithms and analytic techniques

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This work details the theory of numerical solution techniques for the wavefront reconstruction problem. The numerical theory for this problem is divided into two different approaches, the first set theoretic, the second analytic. Due to the ease with which they are implemented, set theoretic approaches, known as iterative transform or projection methods, are the most common. Nevertheless, convergence of these methods is still an open question except in very special cases. Analytic methods, on the other hand, while providing more stable and theoretically sound algorithms, are often complicated and computationally expensive. In addition, analytic fixes to theoretically problematic properties of the most common error metrics, namely nonsmoothness, often lead to worse performance. However, analytic methods have several advantages over set theoretic approaches, principally robustness and acceleration strategies using second-order information. In this work a precise analysis of the correspondence between set theoretic analytic techniques is detailed in order to combine the best properties of both approaches into robust and efficient line search algorithms.