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Lipschitz-based optimization of singular values

Abstract. Singular value optimization problems arise in various applications in control theory. For instance the H_∞ norm of the transfer function of a linear dynamical system, and the distance problems such as complex (or real) stability and controllability radii have singular value optimization characterizations. These problems are non-convex and non-smooth. The existing commonly employed algorithms for these problems are derivative-free, but do not exploit the Lipschitz nature of singular values in a systematic manner. Here we solve these problems largely depending on a Lipschitz optimization algorithm due to Piyavskii and Shubert, that never got attention in the context of optimization of eigenvalues or singular values. The Piyavskii-Shubert based algorithm outperforms the commonly employed algorithms for medium to large scale problems when a few digit accuracy is sought.