Fundamental limits to electromagnetic response across geometric, frequency, and configuration degrees of freedom

Owen D. Miller[1,*]

[1]Dept. of Applied Physics, Dept. of Physics, and Energy Sciences Institute, Yale University, New Haven, CT, USA
*corresponding author, E-mail: owen.miller@yale.edu

Abstract

Electromagnetic design problem are generically hard nonlinear problems that are computationally expensive and prone to getting trapped at low-quality optima. We reformulate electromagnetic-design problems as quadratically constrained quadratic programs (QCQPs). In this formulation, Maxwell's equations are replaced with a set of real- and reactive-power conservation laws, which enable identification of fundamental bounds across geometric, frequency, and configuration degrees of freedom. We show examples of fundamental limits for perfect absorbers, multi-frequency reflectivity sensors, and near-field radiative heat transfer.