# A convex approximation for a PDE constrained fractional optimization problem

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In this talk, a convex algorithm that utilizes a subspace method and a linear approximation technique is presented to solve a particular type of non-convex PDE-constrained optimization problem. This problem gives rise to an infinite-dimensional Hermitian eigenvalue optimization challenge that is characterized by its large scale, non-convexity, and low regularity. To address these issues, we introduce a novel subspace method combined with a vector approximation technique, transforming the problem into a solvable LP problem. Specifically, our algorithm focuses on optimizing photonic band gaps (PBGs) in two-dimensional photonic crystals (PhCs) based on Gallium Arsenide (GaAs). We theoretically prove that the LP relaxation problem serves as an approximation to the PBG optimization problem. The effectiveness of our algorithm is numerically demonstrated through simulations aimed at maximizing the PBGs of a GaAs-based PhC. The results indicate that our algorithm is not only effective but also straightforward to implement.

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