Semidefinite hierarchies for separable diagonal unitary invariant quantum states

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We analyze the DPS hierarchy, a hierarchy of conic approximations for the separable cone, under additional assumptions on the initial bipartite quantum state. States that are invariant under multiplication with diagonal unitary matrices are called CLDUI (conjugate local diagonal unitary invariant) and they admit a sparsity pattern, which allows for separability to be captured efficiently by the cone of pairwise completely positive matrices. We show that the CLDUI sparsity pattern can be extended to any level of the DPS hierarchy. This allows to test membership in the DPS hierarchy more efficiently for CLDUI quantum states. In addition, we show further complexity reduction by reformulating the relaxations in the polynomial optimization framework. These techniques can be also be used to test membership for general states.

Based on joint work with Monique Laurent.