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Decomposition and Schematic Construction of Higher-Dimensional Unitary Transformations BLANE MCCRACKEN, TAE-WOO LEE, CHANGJUN MIN, JONATHAN DOWLING, Louisiana State University — The unitary properties inherent in linear optical components have a wide variety of applications in quantum sciences including imaging, sensing, and quantum computing. Although the complex unitary operations required by many of these sophisticated applications span a large Hilbert space, it has been shown that these operators can be decomposed into a product of multiple two-dimensional subspace transformations. This discovery enables the practical design of any arbitrary unitary transformation proposed in theory. Furthermore, numerical optimization has recently been utilized for generating maximally efficient quantum states and subsequent unitary transformations specific to particular applications. We propose a numerical method of decomposing and schematically constructing the 2-dimensional subspace components required for experimental implementation of any arbitrary unitary operator. Specifically, we demonstrate a practical design to previously discovered, numerically optimized, unitary transformations. Finally, we implement algorithms for minimizing optical components necessary for experimental realization.

Blane McCracken
Louisiana State University

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