

# Optimization with orthogonality constraints and their applications

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Minimization with respect to a matrix  $X$  subject to orthogonality constraints  $X^T X = I$  has wide applications in polynomial optimization, combinatorial optimization, eigenvalue problems, the total energy minimization in electronic structure calculation, sparse principal component analysis,  $p$ -harmonic flow, and matrix rank minimization, etc. These problems are generally difficult because the constraints are not only non-convex but also numerically expensive to preserve during iterations. This talk will present a few recent advance for solving these problems.