

Matrix-Free Convex Optimization Modeling

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- [Full version](#)
- [ICCV version](#)
- [matrix-free CVXPY implementation](#)
- [matrix-free SCS implementation](#)
- [matrix-free POGS implementation](#)
- [a package that integrates matrix-free CVXPY and the solvers](#)

We introduce a convex optimization modeling framework that transforms a convex optimization problem expressed in a form natural and convenient for the user into an equivalent cone program in a way that preserves fast linear transforms in the original problem. By representing linear functions in the transformation process not as matrices, but as graphs that encode composition of linear operators, we arrive at a matrix-free cone program, i.e., one whose data matrix is represented by a linear operator and its adjoint. This cone program can then be solved by a matrix-free cone solver. By combining the matrix-free modeling framework and cone solver, we obtain a general method for efficiently solving convex optimization problems involving fast linear transforms.