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*Constraint Reduction in Filtered Positive $P_N$ Closures for Kinetic Equations.*

We apply a constraint-reduced primal-dual interior-point method to the solution of quadratic programs arising from filtered positive $P_N$ closures for linear kinetic equations. Solving kinetic equations numerically is difficult due to the large state space; moment methods are often used to reduce the size of the state space by tracking a finite number of moments of the distributions. Our filtered positive $P_N$ closure closes moment systems with a non-negative and smooth velocity distribution by filtering the partially negative, oscillatory standard $P_N$ distribution (degree $N$ polynomial approximation that matches moments up to order $N$). The filter is formulated as a finely discretized semi-infinite quadratic program. The resulting distribution no longer exactly matches the given moments, but essential properties are preserved.

At each iteration of an interior-point algorithm, constraint reduction (a technique that has gained popularity in recent years) constructs a search direction based on a set of constraints deemed most critical. On problems with a large number of inequality constraints, this technique significantly lowers the CPU cost. We demonstrate the approach on the 2D line source benchmark problem. (Received January 28, 2014)