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A lattice-based approach to derivative-free optimization PAUL BELITZ, THOMAS BEWLEY, University of California, San Diego — The optimization of an expensive, high-dimensional function when no derivative information is available necessitates the use of a derivative-free optimization algorithm. Such a scenario is evident, for example, when optimizing a finite-time-average approximation of an infinite-time-average statistic of a chaotic system such as a turbulent flow. The truncation error induced by such an approximation renders the calculation of the derivative ineffective. Due to the often significant expense associated with performing repeated function evaluations, a derivative-free optimization algorithm which converges to within an accurate tolerance of the global minimum of a nonconvex function of interest with a minimum number of function evaluations is desired. One of the most efficient algorithms available, known as the Surrogate Management Framework, combines a grid-based pattern search Poll step with inexpensive interpolating "surrogate" functions to provide suggested regions of parameter space in which to perform new function evaluations. The present work considers an SMF algorithm that combines a pattern search based on N-dimensional sphere packings, or lattices, with a highly efficient surrogate search. The lattice-based Poll step offers substantially greater efficiency compared to previous Cartesian grid-based algorithms; combined with an extremely effective Search, a unique, highly efficient SMF algorithm has been devised.

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