Prof. Dr. Andreas Griewank, Humboldt Universität Berlin

Derivative Based Optimization

Abstract

Since Cauchy's time standard optimization methods require the evaluation of first derivatives for objective and constraint functions. At least the existence of these gradients and Jacobians is typically needed to ensure convergence for any optimization method that does not simply cover the feasible domain with sample points. The latter shot-gun approach is clearly unsuitable for high-dimensional problems of current interest.

To beat the 'curse of dimensionality' in nonlinear optimization one can exploit the fact that continuous and discrete adjoints alike yield first and second derivative vectors at costs proportional to the underlying function and constraint evaluations. We discuss the resulting 'selective derivative methods' in comparison to derivative-free-methods in terms of numerical efficiency, applicability, and user convenience. Finally we report numerical experiences from aerodynamics.