Yuri Levin* (ylevin@business.queensu.ca), Queen's University, Kingston, ON, K7L 3N6, CANADA, and **Adi Ben-Israel** (bisrael@rutcor.rutgers.edu), Rutgers University, Piscataway, NJ, 08854, USA, *The Newton Bracketing Method for Minimizing Convex Functions*

Let f be a convex function of n variables, bounded below, with infimum attained. A bracket is an interval [L,U] containing the attained infimum $\min f$. The Newton Bracketing (NB) method [1] is an iterative method that at each iteration does a single Newton iteration and then reduces the bracket by either raising L or lowering U. An initial lower bound L must be provided, and the initial upper bound is $U(x)$ where x is the initial iterate.

Unlike gradient methods (and other iterative methods that directly drive x to optimum), the NB method has a natural stopping criterion: the bracket size. Numerical experience reported here shows the average bracket reduction per iteration is about $1/2$, so convergence is fast.

The method is valid for $n = 1$. It is valid for $n > 1$ (using the directional Newton iteration [2]) provided the level sets of f are not "too narrow". A precise statement for quadratic f, i.e., $f = \frac{1}{2}x^T Qx$ + linear terms, with Q positive definite, is: the NB method is valid if the condition number of Q is $< 1/(7 - \sqrt{48})$ (~ 14).

The method was applied in [1] for solving location (Fermat-Weber) problems, and is applied here to location problems with affine constraints, and to affinely constrained convex programs in general. Applications to trust region subproblems in SDP are developed by H. Wolkowicz.

[1] Y. Levin and A. Ben-Israel, "The Newton Bracketing Method for Convex Minimization," *Computational Optimization and Applications*, **21**(2002), pp. 213-229.

[2] Y. Levin and A. Ben-Israel, "Directional Newton Methods in n Variables," *Math. of Computation*, **71**(2002), pp. 237-250.