1117-90-17 **Jon Lee** (jonxlee@umich.edu) and **Daphne Skipper*** (daphne.skipper@gmail.com). *Virtuous smoothing for global optimization.*

Virtually all exact solvers for global-optimization and mixed-integer nonlinear-optimization (like SCIP, for example) rely on nonlinear-programming (NLP) solvers, both to generate good feasible solutions (yielding upper bounds) and to solve relaxations (yielding lower bounds). Convergence of most NLP solvers requires that functions be twice continuously differentiable. Yet many models naturally utilize functions with some limited nondifferentiability. One approach to handle limited nondifferentiability is smoothing based. We propose a method, mostly aimed at (concave) root functions ($f(x) = x^p$, with $0 < p < 1$) that provides a tighter lower bound than the obvious shift ($g(x) = (x + \epsilon)^p - \epsilon^p$), and is smooth and globally concave, so it works well with local and global solvers. Importantly, lower bounding is critical when root functions appear in inequality constraints [upper bounds are also important, but they are obtained more easily for concave functions]. We lower-bound the derivative via a parameter, so as to accommodate any working precision. A new (hidden) feature of SCIP makes our methodology easy to incorporate. (Received November 12, 2015)