1047-12-415   **Amir Ali Ahmadi** and **Pablo A. Parrilo*** (`parrilo@mit.edu`), Massachusetts Institute of Technology, 77 Massachusetts Ave., Room 32D-726, Cambridge, MA 02139. *A convex polynomial that is not SOS-convex.*

A multivariate polynomial $p(x)$ is sos-convex if its Hessian $H(x)$ can be factored as $H(x) = M^T(x)M(x)$ with a possibly nonsquare polynomial matrix $M(x)$. It is easy to see that sos-convexity is a sufficient condition for convexity of $p(x)$. Moreover, the problem of checking sos-convexity of a polynomial can be cast as the feasibility of a semidefinite program, which can be solved efficiently in polynomial time. Motivated by this computational tractability, it has been recently speculated whether sos-convexity is also a necessary condition for convexity of polynomials. We give a negative answer to this question by presenting an explicit example of a trivariate homogeneous polynomial of degree eight that is convex but not sos-convex. Interestingly, our example is found with software using sum of squares programming techniques and duality theory of semidefinite optimization. (Received February 02, 2009)