1124-14-125 **Timo de Wolff*** (dewolff@math.tamu.edu), Texas A&M University, Department of Mathematics, College Station, TX 77843-3368, and **Sadik Iliman** and **Mareike Dressler**. *New Certificates for Nonnegativity via Nonnegative Circuit Polynomials.*

Deciding nonnegativity of real polynomials is a fundamental problem in real algebraic geometry. Since this problem is NP-hard, one is interested in finding certificates for nonnegativity, which are easier to check. Since the 19th century the standard certificates for nonnegativity are sums of squares (SOS). In practice, one uses semidefinite programming (SDP), which is based on SOS certificates, as the standard method to solve polynomial optimization problems.

We introduce an *entirely new class* of nonnegativity certificate based on *sums of nonnegative circuit polynomials* (SONC), which are *independent* of sums of squares. We establish a Positivstellensatz which guarantees that every polynomial which is positive on a given compact, semi-algebraic set can be represented by the constraints of the set and SONC polynomials.

Similar as SOS correspond to SDP, our certificates correspond to geometric programming and relative entropy programming. We show that our certificates allow to compute lower bounds both for unconstrained and constrained polynomial optimization problems efficiently. Particularly, our approach outperforms semidefinite programming dramatically in various examples. (Received September 04, 2016)