

Lower Bounds on Arithmetic Circuits via Partial Derivatives

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Dedicated to the memory of Roman Smolensky

Abstract

In this paper we describe a new technique for obtaining lower bounds on restricted classes of nonmonotone arithmetic circuits. The heart of this technique is a complexity measure for multivariate polynomials, based on the linear span of their partial derivatives. We use the technique to obtain new lower bounds for computing symmetric polynomials (which hold over fields of characteristic zero) and iterated matrix products (which hold for every field).