

ACC Circuit Lower Bounds

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Abstract

The circuit class ACC consists of circuit families with constant depth over unbounded fan-in AND, OR, NOT, and MOD m gates, where $m > 1$ is an arbitrary constant. We will describe a proof that there is a function in NEXP (nondeterministic exponential time) which does not have polynomial size ACC circuits. For the larger class EXP^{NP} (exponential time with an NP oracle), exponential size ACC lower bounds can be proved. (It was open whether EXP^{NP} could be computed with depth-3 polynomial size circuits made out of only MOD6 gates.)

The proof shows that the task of proving ACC circuit lower bounds for NEXP can be reduced to the task of designing ACC circuit satisfiability algorithms that only slightly improve upon exhaustive search. (This reduction holds for a variety of circuit classes, not just ACC.) The proof is completed by explicitly providing a faster algorithm for ACC circuit satisfiability.