

- ERFAN KHANIKI, *Nisan–Wigderson generators in Proof Complexity: New lower bounds.*

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A map $g : \{0, 1\}^n \rightarrow \{0, 1\}^m$ ($m > n$) is a hard proof complexity generator for a proof system P iff for every string $b \in \{0, 1\}^m \setminus \text{Rng}(g)$, formula $\tau_b(g)$ naturally expressing $b \notin \text{Rng}(g)$ requires superpolynomial size P -proofs. One of the well-studied maps in the theory of proof complexity generators is Nisan–Wigderson generator. Razborov [1] conjectured that if A is a suitable matrix and f is a $\text{NP} \cap \text{CoNP}$ function hard-on-average for P/poly , then $\text{NW}_{f,A}$ is a hard proof complexity generator for Extended Frege.

In this talk, we prove a form of Razborov’s conjecture for AC^0 -Frege. We show that for any symmetric $\text{NP} \cap \text{CoNP}$ function f that is exponentially hard for depth two AC^0 circuits, $\text{NW}_{f,A}$ is a hard proof complexity generator for AC^0 -Frege in a natural setting.

[1] A. A. RAZBOROV, *Pseudorandom generators hard for k -DNF resolution and polynomial calculus resolution*, *Annals of Mathematics. Second Series*, vol. 191, no. 2, pp. 415–472.