1135-00-189 **Antonina Kolokolova*** (kol@mun.ca). *Power of reasoning over richer domains.*

How does the richness of underlying concepts affects the power of reasoning systems built on them? This question arises in many different settings, from automated reasoning to mathematical proofs.

Does it help to augment propositional, resolution-based reasoning used in modern Satisfiability solvers with non-propositional reasoning in underlying theory such as arithmetic? We show that even a theory of uninterpreted functions, decidable in near-linear time, helps enormously: resolution over that theory can simulate a much more powerful Frege (natural deduction) system.

Then, we look at complexity of proofs of existence of expander graphs, pseudorandom objects widely used in theoretical computer science. Surprisingly, we show that it is possible to prove existence their existence by purely combinatorial and probabilistic reasoning, using only concepts definable by polynomial-size formulas. An interesting corollary is that monotone natural deduction reasoning is just as powerful as its non-monotone counterpart, in stark contrast to circuit complexity.

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