

Analogues of Toda's Theorem

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In classical complexity theory, Toda's theorem gave a somewhat unexpected connection between two generalizations of the class NP: it states that the polynomial hierarchy PH is solvable in polynomial time if we're given access to an oracle to a #P-complete problem. While the complexity classes involved readily admit analogues in the BSS model of computation, the probabilistic methods used in the classical proof of Toda's theorem appear impossible to extend to that setting.

In this talk, I will discuss the proof of an analogue of Toda's theorem for the BSS model over the reals (joint work with Saugata Basu) and over the complexes (Basu). One important aspect of this result is that it led us to prefer a topological definition of the class #P, in order to apply algebraic topology techniques such as duality and spectral sequences. I will also mention how this approach might yield a different proof of Toda's theorem in the discrete case.