

Abstract:

Is matching in NC, i.e., is there a deterministic fast parallel algorithm for it? This has been an outstanding open question in TCS for over three decades, ever since the discovery of Random NC matching algorithms. Within this question, the case of planar graphs has remained an enigma: On the one hand, counting the number of perfect matchings is far harder than finding one (the former is #P-complete and the latter is in P), and on the other, for planar graphs, counting has long been known to be in NC whereas finding one has resisted a solution!

The case of bipartite planar graphs was solved by Miller and Naor in 1989 via a flow-based algorithm. In 2000, Mahajan and Varadarajan gave an elegant way of using counting matchings to finding one, hence giving a different NC algorithm.

However, non-bipartite planar graphs still didn't yield: the stumbling block being odd tight cuts. Interestingly enough, these are also a key to the solution: a balanced odd tight cut leads to a straightforward divide and conquer NC algorithm. The remaining task is to find such a cut in NC. This requires several algorithmic ideas, such as finding a point in the interior of the minimum weight face of the perfect matching polytope and uncrossing odd tight cuts.

Paper available at: <https://arxiv.org/pdf/1709.07822.pdf>

Joint work with Nima Anari.

About the speaker:

Vijay Vazirani is a leading theoretical computer scientist, with seminal contributions in many areas, e.g., in complexity theory, algorithmic matching theory, approximation algorithms, algorithmic game theory, computability of market equilibria, etc. Two of his most significant contributions are: if UNIQUE-SAT is in P then $NP = RP$ (Valiant-Vazirani Theorem), and an algorithm for finding maximum matchings in general graphs, the best algorithm for the problem till date.