On the planar disjoint paths problem

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Abstract

In the course of their proof of Wagner's Conjecture, Robertson and Seymour developed an algorithm for the disjoint paths problem, which is probably one of the most famous polynomial time algorithms in theoretical computer science. The disjoint paths problem asks, given a graph G with k pairs $(s_1, t_1), \ldots, (s_k, t_k)$ of vertices, whether there exist k pairwise vertex-disjoint paths $P_1, \ldots, P_k$ in G such that each P_i connects s_i to t_i. Their algorithm runs in time $f(k) \cdot |G|^3$, where f is a computable function. Nevertheless, the algorithm is only of theoretical interest, because the parameter dependence f is gigantic (in the proof, the funcion f is a huge tower of iterated exponentials, and the precise order of f was not determined). The main source of the huge parameter dependence is the so-called 'irrelevant vertex technique' (introduced in Robertson and Seymour's - very technical - paper *Graph Minors XXII*).

In my talk I will present a new and much simpler proof for finding irrelevant vertices in *planar* graphs. This improves the parameter dependence to double-exponential.

This is joint work with Stavros Kolliopoulos, Philipp Krause, Daniel Lokshtanov, Saket Saurabh, and Dimitrios Thilikos.