A journey through the algorithms for the stable set problem in claw-free graphs

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The (weighted) stable set problem in claw-free graphs is a fundamental generalization of the matching problem. In fact, claw-free graphs are a superclass of line graphs, and the (weighted) stable set problem in line graphs is equivalent to the (weighted) matching problem. Building upon the current state-of-the-art algorithm for the weighted matching problem (by Gabow), the weighted stable set problem in a line graph $G(V, E)$ can be solved in time $O(|V|^2 log(|V|))$.

In this talk, we will surf through several algorithms that have been proposed both for the weighted and the unweighted stable set problem in claw-free graphs, starting from the classical algorithm from 1980 due to Minty, passing by the elegant algorithm for the unweighted case due Lovász and Plummer in 1986 etc. We will also take a detour to look at some deep decomposition theorem for claw-free graphs due to Chudnovsky and Seymour. And we will be particularly interested in discovering features of stable sets in claw-free graphs that go beyond matchings.

Our journey will take us to the current state-of-the-art algorithm for the problem, that finds a maximum weighted stable set in a claw-free graph $G(V, E)$ in time $O(|V|^3)$. And it will take us to the following question: is there any hope of closing the gap between the complexity of the problem in claw-free graphs, i.e. $O(|V|^3)$, and in line graphs, i.e. $O(|V|^2 log(|V|))$?