Parameterized Algorithms for Beyond-Planar Graphs

Doktorandenkolloquium am Mittwoch, 16.07.2025
im Raum VR147b, JUR, Innstr. 39, Universität Passau, 94032 Passau
um 14:50 Uhr
von Frau Miriam Münch

Betreuung: Prof. Dr. Ignaz Rutter

In practice, many graphs and networks are non-planar; they are however usually sparse and admit drawings where crossings are well-distributed. The goal of beyond-planarity is to extend results known for planar graphs to more general graph classes. Unfortunately, the recognition problem is known to be NP-complete for many beyond-planar graph classes; polynomial-time algorithms are only known for very restricted subclasses. This leads to the question for which beyond-planar graph classes the corresponding recognition problem is fixed parameter tractable (FPT); i.e, which recognition problems admit a running time that is polynomial in the input size but depends (almost) arbitrarily on a given parameter.

Typically, beyond-planar graph classes are defined via forbidden crossing patterns. We formalize these concepts both on a combinatorial and on a topological level and show that for any fixed family $\mathcal{F}$ of crossing patterns, deciding whether a given graph G admits a drawing that avoids all patterns in $\mathcal{F}$ and that has at most c crossings is FPT with respect to c. This meta theorem yields FPT algorithms for the recognition problem for several beyond-planar graph classes such as k-planar, k-quasi-planar, fan-planar or straight-line 1-planar graphs.