

# Semester Report SS03 of Dirk Schlatter

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Field of Research: Random Discrete Structures  
Topic: Planar Graphs  
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## Field of Research

During the past semester, my work has mainly been focused on the problem of finding a *maximum planar subgraph of a graph  $G$* . For  $G$  a random graph with edge probability  $p$ , the related graph property of containing a planar subgraph with  $\alpha n$  edges is clearly monotone and thus has a threshold. For non-integral values in the range  $1 < \alpha < 3$ , so far I was only able to prove that this threshold can be bounded between  $n^{-\frac{1}{\alpha}}$  and  $n^{-\frac{1}{\alpha}+\epsilon}$ , for  $\epsilon$  an arbitrarily small positive constant. However, the remaining gap is still quite large, and it seems that new ideas will be needed in order to close it. In an attempt to decrease the upper bound, I have followed two different approaches, based on papers by Janson [2] and Riordan [3], which up to now turned out to be unsuccessful.

Recently, my attention has shifted towards the deterministic case, where the best known approximation algorithm by Călinescu, Fernandes, Finkler, and Karloff [1] has worst-case ratio  $\frac{4}{9}$ . I am currently cooperating with M. Schacht, a PhD student from Emory University in Atlanta, in order to find an improved version of this algorithm.

## Activities

### Conferences and Workshops

- MARCH 31 – APRIL 11 Block Course on *Applied Network Optimization* at the TU Berlin
- MAY 5 – 23 Workshop on *Combinatorics, Probability and Algorithms* at the CRM, Montreal
- AUGUST 9 – 13 11th International Conference on *Random Structures and Algorithms* in Poznan

## Lectures and Seminars

- WEEKLY lectures and colloquia of the CGC
- WEEKLY seminar of the research group *Algorithmen* at the HU Berlin (talk: *An approximation algorithm for the maximum planar subgraph problem*, July 18)
- WEEKLY seminar on *Semidefinite Programmierung* at the HU Berlin (talk: *The MaxCut approximation algorithm by Goemans and Williamson*, June 6 and 13)
- WEEKLY seminar on *The strange logic of random graphs* at the HU Berlin (talk: *Very sparse graphs*, June 11)
- MAY 30 *Berlin – Poznan Seminar on Combinatorics* (talk: *Maximum planar subgraphs of random graphs*)

## Preview

In the near future, I plan to continue the joint work on approximation algorithms for the maximum planar subgraph problem, which will probably last until the end of August. Meanwhile, I also hope to get involved in the work on random planar graphs and the uniform generation of planar graphs by A. Taraz, and M. Boudirsky, M. Kang, respectively.

## References

- [1] G. Călinescu, C.G. Fernandes, U. Finkler, H. Karloff, *A Better Approximation Algorithm for Finding Planar Subgraphs*, Proceedings of the 8th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), p. 629–638, 1997
- [2] S. Janson, *The numbers of spanning trees, Hamilton cycles and perfect matchings in a random graph*, Combinatorics, Probability & Computing 3 p. 97–126, 1994
- [3] O.M. Riordan, *Spanning Subgraphs of Random Graphs*, Universität Bielefeld, SFB 343, pre-print 98-051, 1998