

algebraic topology such as homotopy, homology, and universal covers of surfaces.

Based on joint works with Vincent Cohen-Addad, Arnaud de Mesmay, and Dániel Marx.

Shorter Implicit Representation for Planar Graphs

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For a graph family \mathcal{F} , a *labeling scheme* is an algorithm that given a graph G of \mathcal{F} , assigns bit strings (labels) to vertices of G so that for any two vertices u, v , whether u and v are adjacent can be determined by a fixed procedure that examines only their labels. It is known that planar graphs admit a labelling scheme with labels of $2 \log n$ bits asymptotically. In this work we improve this result by constructing a new labeling scheme with labels of length $\frac{4}{3} \log n + O(\log \log n)$.

In graph-theoretical terms, this implies that there exists a graph on $n^{4/3+o(1)}$ vertices that contains all planar graphs on n vertices as induced subgraphs, improving the best known upper bound of $n^{2+o(1)}$.

This is a joint work with Marthe Bonamy and Michał Pilipczuk.

On Colourability of Polygon Visibility Graphs

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We study the problem of colouring visibility graphs of polygons. In particular, for visibility graphs of simple polygons, we provide a polynomial algorithm for 4-colouring, and prove that the 5-colourability question is already NP-complete for them. For visibility graphs of polygons with holes, we prove that the 4-colourability question is NP-complete.

Joint work with Onur Cagirici and Bodhayan Roy. Preliminary version published at FSTTCS 2017.

Spanoids, Greedoids and Violator Spaces

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The main goal of this talk is to make connections between four independently developed theories: spanoids, greedoids, closure spaces, and violator spaces.

Closure spaces appear in many disciplines, including topology, algebra, logic, geometry, convex analysis, graph theory and the theory of ordered sets (Jamison, 2019, in press). It also goes by the names of span, hull, and envelope. The convex hull operator on the Euclidean space E^n is a classic example of a closure operator. Spanoids were recently introduced as logical inference structures with applications in coding theory (Dvir, Goppy, Gu, Wigderson, 2019). We prove that each spanoid is a closure space, while every closure space may be represented as a spanoid.

In 1996, LP-type problems was introduced and analyzed by Matoušek, Sharir and Welzl as a combinatorial framework that encompasses linear programming and other geometric optimization problems. Further, (Matoušek et al. 2008) defined a more general framework, namely,