Galilean Bobillier Formula for One Parameter Planar Motions

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In this present paper, Galilean Euler Savary formula for the radius of curvature of the trajectory of a point in the moving Galilean plane during one parameter planar motion is taken into consideration and using the geometrical interpretation of the Galilean Euler Savary formula, Galilean Bobillier formula is obtained for one parameter planar motions in the Galilean plane.
Moreover, a direct way is chosen to obtain Bobillier formula without using the Euler Savary formula in the Galilean plane. As a consequence the Galilean Euler Savary will appear as a specific case of Bobillier formula given in the Galilean plane.

A density Corrádi-Hajnal theorem

PETER ALLEN

London School of Economics

Extending results of Mantel, of Erdős and of Moon, with Böttcher, Hladký and Piguet we determined for all sufficiently large n and each $0 \leq k \leq n/3$ the maximum number of edges in an n vertex graph which does not contain $k + 1$ vertex disjoint triangles. In this talk I will describe the surprisingly complicated answer and sketch the proof, which is elementary (in particular it does not use Szemerédi's Regularity Lemma) but fairly intricate, and explain why it is not so straightforward to replace 'triangle' with K_t for $t \geq 4$.

Planar point sets with many perfect matchings

ANDREI ASINOWSKI

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Let n be an even natural number. Denote by $\mathsf{pm}(n)$ the maximal number of non-crossing straight-line perfect matchings that a planar set of n points in general position can have. The following bounds on $\mathsf{pm}(n)$ are known: $\mathsf{pm}(n) = O(10.05^n)$ (Sharir and Welzl, 2006) and $\mathsf{pm}(n) = \Omega(3^n)$ (García, Noy, and Tejel, 2000). This lower bound was proven by a construction – the so called *double chain.* We present several constructions that have asymptotically more perfect matchings than the double chain and improve the lower bound to $\Omega(3.09^n)$.

This is a joint work with Günter Rote (Freie Universität Berlin).

How dense are range capturing hypergraphs?

MARIA AXENOVICH

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For a finite set X of points in the plane, a set S, called a range, and a positive integer k, we say that a k-element subset Y of X is captured by S if there is a homothetic copy S' of S such that $S' \cap X = Y$. A k-uniform S-capturing hypergraph $H(X, S, k)$ has a vertex set X and a hyperedge set consisting of all k-element subsets captured by S. For example, when S is a unit disc centered at the origin and $k = 3$, then each hyperedge of $H(X, S, k)$ is a triple of points from X such that some disc contains exactly these three points from X.
In this talk, I will discuss covering, coloring, and density problems of range capturing hypergraphs. I will show that the largest number of edges in such a hypergraph is at most $(2k-1)|X| + O(k^2)$ and that this bound is tight up to ck^2.

This is a joint work with Torsten Ueckerdt.

Real Variable Serret Frenet Formulae of an Octonion Valued Function (Octonionic Curves)

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In this study, we treate a subject is named as octonionic curve in $\mathbb{R}^7$ and $\mathbb{R}^8$, we single out the indication for Serret Frenet formulae and the Frenet frames of the octonionic curve in $\mathbb{R}^7$ and demonstrate that how octonions are to be used in assignmenting the curvature amount of curves in general. However we have procured the Serret Frenet Formulae and Frenet apparatus for the octonionic curve in $\mathbb{R}^8$ by doing roll of the Serret Frenet formulae for a octonionic curve in $\mathbb{R}^7$.

Irregular vertex colorings of cartesian products of paths and cycles

JENS-P. BODE

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The color code of a vertex $v \in V$ with respect to a proper vertex k-coloring c is the ordered $(k+1)$-tuple $\mathrm{code}(v) = (a_0, a_1, \ldots, a_k)$ where $a_0 = c(v)$ and a_i, $i = 1, \ldots, k$, is the number of vertices of color i that are adjacent to v. The coloring c is called irregular if the codes of all vertices are pairwise different. The irregular chromatic number $\chi_{ir}(G)$ of G is the minimum k such that G has an irregular k-coloring. We consider the irregular chromatic number of cartesian products of paths and cycles.

Joint work with Arnfried Kemnitz and Zuzana Moravcová.

An approximate version of the Tree Packing Conjecture

JULIA BOETTCHER

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We prove that for any pair of constants $\varepsilon > 0$ and Δ and for n sufficiently large, every family of trees of orders at most n, maximum degrees at most Δ, and with at most $n(n-1)/2$ edges in total, packs into $K_{1+\varepsilon}n$. This implies asymptotic versions of the well-known tree packing conjecture of Gyárfás from 1976 and another tree packing conjecture of Ringel from 1963 for trees with bounded maximum degree. A novel random tree embedding process combined with the nibble method forms the core of the proof. In the talk I will in particular describe our random tree embedding process and explain how we use it to obtain our result.

Joint work with Jan Hladký, Diana Piguet, Anusch Taraz.

On Rainbow Independent Sets

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Motivated by practical situations, we introduce the concept of rainbow independent sets and based on it we formulate four graph theoretical problems, which model those situations. In this talk we will study their complexity, their relationship to other known invariants, for example the independence number α, and some bounds for their optimal values.

On (claw,even-hole)-free graphs

STEVEN CHAPLICK

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We study graphs without *claws* ($K_{1,3}$) and without even length cycles (C_{2k+4}) as induced subgraphs. We describe the structure of this graph class using the clique cutset decomposition and use this to bound their treewidth in terms of their clique number and to provide polynomial time recognition and colouring algorithms for this class of graphs.

This is joint work with Kathie Cameron and Chinh Hoàng from Wilfrid Laurier University (Waterloo, Canada).

On 1-planar graph joins

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A graph is called 1-planar if it admits a drawing in the plane such that each edge is crossed at most once. We show that the join $G + H$ is 1-planar if and only if the pair $[G, H]$ is subgraph-majorized by a pair $[G', H']$ (meaning that G is a subgraph of G' and H is a subgraph of H'), where $[G', H'] \in \{[C_3 \cup C_3, C_3], [C_4, C_4], [C_4, C_3], [K_{2,1,1}, P_3]\}$ in the case when both elements of the graph join have at least three vertices. If one element has at most two vertices, then we give several necessary/sufficient conditions for the bigger element.

Some Bounds for the sum of the Laplacian eigenvalues of graphs

ISRAEL DE SOUZA ROCHA

Instituto de Matemtica/UFRGS, Fakultät für Mathematik/TU Chemnitz

An open conjecture in Spectral Graph Theory concerns the sum of the largest Laplacian eigenvalues of graphs. This conjecture, proposed by A.E. Brouwer, suggest a sharp upper bound on this sum. In this talk we discuss some results on this problem and we show that Brouwers conjecture holds for certain classes of graphs. We also give upper bounds for the sum of the largest Laplacian eigenvalues for graphs satisfying certain properties: those that contain a path or a cycle of a given size, graphs with a given matching number and graphs with a given maximum degree. Then we provide conditions for which these upper bounds are better than the previous known results.

On the counting of independent domination sets

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A vertex subset $D \subseteq V$ of the graph $G = V, E$ is an independent dominating set if every vertex in $V \backslash D$ is adjacent to at least one vertex in D and D is an independent vertex subset of the graph. Then the independent domination polynomial is the ordinary generating function for the number of independent dominating sets in a graph. In this talk we introduce nice properties and recurrence equations of this polynomial. Additionally we will show interesting connections to other well known counting problems.

On Sums of Type $\sum_{A \subseteq S} f(A)$

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We establish a broad generalization of a theorem of Whitney on the chromatic polynomial of a graph to sums of type $\sum_{A \subseteq S} f(A)$ where S is a finite set and f is a mapping from the power set of S into an abelian group. We give several applications of this generalization, e.g., within the scope of reliability theory and number theory.

Unique-maximum coloring of plane graphs

IGOR FABRICI

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A *unique-maximum k-vertex-coloring* (*k-edge-coloring*) *with respect to faces* of a (2-edge-connected) plane graph G is a vertex-coloring (an edge-coloring) with colors $1, \dots, k$ so that, for each face α of G, the maximum color in α occurs exactly once on the vertices (edges) of α. In this talk we present upper bounds on the corresponding chromatic numbers.

The talk is based on joint work with Frank Göring, Stanislav Jendroľ, and Michaela Vrbjarová.

Symmetries of Monocoronal Tilings

DIRK FRETTLÖH

Technische Fakultät, Universität Bielefeld

The vertex corona of a vertex of some tiling is the vertex together with the adjacent tiles. A tiling (aka tesselation) where all vertex coronae are congruent is called monocoronal. We provide a classication of monocoronal tilings in the Euclidean plane and derive a list of all possible symmetry groups of monocoronal tilings. In particular, any monocoronal tiling with respect to direct congruence is crystallographic, whereas any monocoronal tiling with respect to congruence (reflections allowed) is either crystallographic or it has a one-dimensional translation group.

This is joint work with Alexey Garber (Moscow).

House of Graphs: a database of interesting graphs

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In this talk we will present a new online searchable database of graphs. Next to complete lists of several graph classes (such as fullerenes or snarks), also a list of graphs that already turned out to be *interesting* and *relevant* in the study of graph theoretic problems is offered. We will demonstrate how users can perform queries on this database and how they can add new *interesting* graphs to it.

House of Graphs is accessible at http://hog.grinvin.org

This is joint work with Gunnar Brinkmann, Kris Coolsaet and Hadrien Mélot.

On discrete Inverse problems: theory, algorithms and applications

PETER GRITZMANN

Technische Universität München

Natural and material sciences provide a wealth of mathematically and algorithmically challenging discrete inverse problems. Examples include Plasma particle tracking (A), Diffraction tomography (B) and Grain map reconstruction (C). Mathematically, A can be viewed as a specifically constrained network optimization problem, B leads to a hypergraph matching problem while C involves new clustering algorithms providing power diagrams.
The results reported in the talk are joint (and ongoing) work with Andreas Alpers (A, B, C), Andreas Brieden (C), Carl Georg Heise (B), Dmitry Moseev (A), Henning Poulsen (C), Mirko Salewski (A) and Anusch Taraz (B).

One-Parameter Planar Motions in Affine Cayley-Klein Planes

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In this paper, we will introduce one parameter planar motions in affine Cayley-Klein (CK) planes $\mathbb{P}_\epsilon$ and we will discuss the relations between absolute, relative, sliding velocities and accelerations.

A new combinatorial interpretation of r-Whitney and r-Whitney-Lah numbers

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T. A. Dowling introduced Whitney numbers of the first and second kind concerning the so-called Dowling lattices of finite groups. It turned out that they are generalizations of Stirling numbers. Later, I. Mező defined r-Whitney numbers as a common generalization of Whitney numbers and r-Stirling numbers. Additionally, G.-S. Cheon and J.-H. Jung defined r-Whitney-Lah numbers in connection with r-Whitney numbers.
Several authors gave different interpretations of these numbers. In our talk, we give a new combinatorial interpretation which correspond better with the combinatorial definition of Stirling, r-Stirling, Lah and r-Lah numbers. It allows us to derive new identities and properties of r-Whitney and r-Whitney-Lah numbers combinatorially.

(This is a joint work with Gábor Nyul.)

Adding lattice points in lattice polytopes

CHRISTIAN HAASE

Freie Universität Berlin

The sum of k lattice points in a lattice polytope P is a lattice point in the dilated polytope kP. But in general, not every lattice point in kP can be decomposed in this way.
The very basic question for which polytopes such a decomposition always exists plays a role in a variety of mathematical fields. It goes by the name “integer decomposition property” in Integer Programming and by the name “integrally closed” (or “normal”) in Commutative Algebra.
In this talk I will discuss what we know (and what we do not know) about this question and the related question about writing a lattice point in a Minkowski sum $P + Q$ as a sum of a lattice point in P and a lattice point in Q.

This is joint work with Jan Hofmann (Frankfurt/Berlin).

Steinhaus Triangles with Generalized Pascal Addition

HEIKO HARBORTH

Technische Universität Braunschweig

Steinhaus triangles consist of a row with n plus and minus signs and in the following rows a plus is written under two equal signs and a minus is written under two different signs. Hugo Steinhaus in 1963 has asked whether a first row can be chosen such that the numbers of plus and of minus signs are the same.
With digits 0 and 1 instead of + and - the operation is as in Pascal's triangle modulo 2. In a generalized Pascal triangle modulo 2 the operation is generalized to the sum of s consecutive digits of the preceeding row. Here it will be discussed whether there exist corresponding balanced triangles with equal numbers of digits 0 and 1.

(Common work with Jens-P. Bode.)

Slopes of segment intersection graphs

UDO HOFFMANN

Technische Universität Berlin, Institut für Mathematik

I will show that it is NP-hard to determine the minimal number of slopes that is required to draw a segment representation of a segment intersection graph. As a side product we obtain new proofs for the NP-hardness of the recognition of grid, segment and pseudosegment graphs. We show as well, that the minimal number of slopes of a segment graph can drop arbitrarily upon the removal of a single vertex.

Induced Matchings

FELIX JOOS

Universität Ulm

Recent results and open problems concerning induced matchings are presented. We are mainly interested in lower bounds in terms of the maximum degree and the number of vertices (edges). These results are stimulated by the famous conjecture of Erdős and Nešetřil, saying that the edge set of every graph with maximum degree Δ can be decomposed into $\frac{5}{4}\Delta^2$ induced matchings. However, this conjecture is widely open.

3-colorability of Planar Graph

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It is well known that every planar graph is 4-colorable. In 1976, Steinberg conjectured that every planar graph without cycles of length 4 and 5 is 3-colorable. In 2008, Montassier et al showed that every planar graph without cycles of length at most five at distance less than four is 3-colorable. In 2010, Borodin, Montassier and Raspaud asked: whether every planar graph without adjacent cycles of length at most five is 3-colorable? In this talk, we prove that every planar graph with every two five cycles at distance at least three is 3-colorable. This is a joint work with Yingqian Wang.

Containment of H-Polytopes in V-Polytopes: Linear and Semidefinite Relaxations

KAI KELLNER

Goethe-Universität Frankfurt

Given an H-polytope P and a V-polytope Q, the decision problem whether P is contained in Q is co-NP-complete. This hardness remains if P is restricted to be a standard cube and Q is restricted to be (the affine image of) a cross polytope. Since this hardness classification by Freund and Orlin (see also Gritzmann and Klee), there seems to be only limited progress on that problem so far.
We formulate the H-in-V containment problem in terms of a bilinear feasibility problem and characterize its geometric properties. The application of Handelman's Positivstellensatz and Putinar's Positivstellensatz yields hierarchies of linear programs and semidefinite programs, respectively, to decide the containment problem. As a main result, we show that under mild preconditions the Putinar representation converges in finitely many steps. In particular, this is the case if P is the standard cube and Q is the standard cross polytope.

Interval Total Colorings of Complete Multipartite Graphs and Hypercubes

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A total coloring of a graph G is a coloring of its vertices and edges such that no adjacent vertices, edges, and no incident vertices and edges obtain the same color. An interval total t-coloring of a graph G is a total coloring of G with colors $1, \ldots, t$ such that all colors are used, and the edges incident to each vertex v together with v are colored by $d_G(v) + 1$ consecutive colors, where $d_G(v)$ is the degree of a vertex v in G. In this talk we show that all complete multipartite graphs with the same number of vertices in each part are interval total colorable. Moreover, we also give some bounds for the minimum and the maximum span in interval total colorings of these graphs. Next, we investigate interval total colorings of hypercubes Q_n. In particular, we show that Q_n ($n \geq 3$) has an interval total t-coloring if and only if $n + 1 \leq t \leq \frac{(n+1)(n+2)}{2}$.

Long Paths in Line Arrangements

UDO HOFFMANN, LINDA KLEIST, AND TILL MILTZOW

TU Berlin and FU Berlin

An arrangement of lines partitions the plane into vertices, edges and faces. A path in a line arrangement is a sequence of faces where every two consecutive faces are adjacent and each face occurs at most once. We prove that every arrangement of n lines allows for a path of length $\frac{1}{3}n^2 - O(n)$. This is tight up to the linear order term. We also consider arrangements of red and blue lines, where our paths must cross red and blue edges alternatingly.

Refined Counting of Linear Extensions

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Incomparable neighboring elements in a linear extension of a poset form a jump. Finding the smallest number of jumps in a linear extension of a poset is known as the jump number problem, which is NP-hard. Counting linear extensions of posets is #P-hard.
We show that counting linear extensions with a fixed number of jumps is #P-hard as well. Furthermore, we develop formulas to efficiently calculate these numbers for special cases of posets, which is equivalent to calculating the degree sequence of the respective linear extension graphs.

Augmenting Approach for the Maximum Induced Matching Problem

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The Maximum Induced Matching problem (MIMp), asking for an induced matching of maximum cardinality in a graph G, is NP-hard in general. The method of augmenting graphs is a general approach to solve the Maximum Independent Set problem. Our objective is to employ this technique to develop a polynomial time algorithm for the MIMp in a speacial graph class.

V-direction Curve of a Surface Curve in $\mathbb{E}^3$

Nesibe MACİT, Mustafa DÜLDÜL

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In this study, we define V-direction curve which is associated with a curve lying on an oriented surface in $\mathbb{E}^3$. This new associated curve is defined as the integral curve of the vector field taken from the Darboux frame $\{\mathsf{T}, \mathsf{V}, \mathsf{U}\}$ along the curve. Some characterizations of such curves are studied and then some examples are given.

Light edges in families of plane graphs - recent development

TOMÁŠ MADARAS

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One of the key results in structural theory of planar graphs is the Kotzig theorem stating that each polyhedral (that is, 3-connected planar) graph contains an edge of weight (the sum of degrees of its endvertices) at most 13, and at most 11 in the case of absence of 3-valent vertices. Within years, this theorem found numerous generalizations and analogues; we focus our attention on selected recent results concerning the light edges in families of planar graphs with prescribed numbers of vertices and edges, the light edges surrounded by faces of bounded degree and the light edges in certain "exotic" subfamilies of planar or polyhedral graphs.

Sum list colorings of complete multipartite graphs

MASSIMILIANO MARANGIO

Computational Mathematics, Technische Universität Braunschweig

Let $G = (V, E)$ be a simple graph and for every vertex $v \in V$ let $L(v)$ be a list of available colors. G is called L-*colorable* if there is a proper vertex coloring c with $c(v) \in L(v)$ for all $v \in V$. A function $f : V \to \mathbb{N}$ is called a *choice function* of G if G is L-colorable for every list assignment L with $|L(v)| = f(v)$ for all $v \in V$. Set $\mathrm{size}(f) = \sum_{v \in V} f(v)$ and define the *sum choice number* $\chi_{sc}(G)$ as the minimum of $\mathrm{size}(f)$ over all choice functions f of G.
General bounds for $\chi_{sc}(G)$ of a connected graph G are $2|V| - 1 \leq \chi_{sc}(G) \leq |V| + |E|$. A graph G is called sc-*greedy* if $\chi_{sc}(G) = |V| + |E|$.
In this talk all connected graphs whose sum choice number attains the lower bound $2|V|-1$ or $2|V|$ are determined. Moreover, an entire characterization which complete multipartite graphs are sc-greedy and which are not is given.

This is joint work with Arnfried Kemnitz and Margit Voigt.

On-line coloring between two lines

PIOTR MICEK

Jagiellonian University Kraków

We propose an on-line algorithm coloring convex sets spanned between two parallel lines and using O(w^3) colors where w is the chromatic number of presented family. An intersection graph of convex sets spanned between two parallel lines generalizes a number of well-studied intersection graph classes: permutation graphs, interval graphs, simple-triangle, triangle and trapezoid graphs. Effective on-line algorithms were known only for permutation graphs (Schmerl 1979) and interval graphs (Kierstead, Trotter 1981). We discuss interactions of families of convex sets with other classes of posets: all height-2 posets and all 2-dimensional posets can be represented by such a family but there is a height-3 and 3-dimensional poset that cannot.

Token Swapping

SPEAKER: TILLMANN MILTZOW,
JOINT WITH JIŘÍ MATOUŠEK, LOTHAR NARRINS, JOSHIO OKAMOTO, GÜNTER ROTE, ANTONIS THOMAS, TAKEAKI UNO

Given a graph $G = (V, E)$ with $V = \{1, \ldots, n\}$, we place on every vertex a token $T_1, \ldots, T_n$. A swap is an exchange of tokens on adjacent vertices. We consider the algorithmic question of finding a minimum sequence of swaps such that token T_i is on vertex i. We show two general 4-approximations and NP-hardness. Our results also hold for a relaxed version, where tokens and vertices are colored. In this relaxed version each token must go to any vertex with the same color.

How many symbols for *k*-Thue sequences?

MARTINA MOCKOVČIAKOVÁ

University of West Bohemia, Pilsen, Czech Republic

A sequence is *Thue* or *nonrepetitive* if it does not contain a repetition of any length. In this talk we consider a generalization of this notion. A j-subsequence of a sequence S is a subsequence in which two consecutive terms are at indices of difference j in S. A k-*Thue sequence* is a sequence in which every j-subsequence, for $1 \leq j \leq k$, is also Thue. It was conjectured that $k + 2$ symbols are enough to construct an arbitrarily long k-Thue sequence and shown that the conjecture holds for $k = 2, 3$ and 5. We present a construction of k-Thue sequences on $2k$ symbols, which improves the previous bound of $2k + 10\sqrt{k}$. Additionaly, we define cyclic k-Thue sequences and show that four symbols suffice to construct a cyclic 2-Thue sequence of any length, with three exceptions. As a corollary, we obtain a tight bound on total Thue coloring of cycles.

This is a joint work with Jaka Kranjc, Borut Lužar and Roman Soták.

Generation of Nanojoins

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In this presentation a constructive algorithm for generating nanojoins is proposed. A nanojoin is a chemical structure joining the well know fullerene nanotubes. We model a nanojoin as a planar graph. Vertices correspond to atoms and edges to the bonds between the atoms. Many articles that give examples of nanojoins can be found in the literature, but never before an algorithm has been published that generates all nanojoins for a given parameter set.

A sufficient condition leading to the domination number of a bipartite graph

MISA NAKANISHI
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In this paper, a graph $G = (V, E)$ is undirected with no loop. A set of vertices X such that the closed neighborhood satisfies $N_G[X] = V$ is called a dominating set. The minimum and maximum cardinality taken over all minimal dominating sets of G are the domination number $\gamma(G)$ and upper domination number $\Gamma(G)$ respectively. Also the minimum cardinality taken over all maximal independent sets of G is the independent domination number $i(G)$. A sufficient condition for $\gamma(G) = i(G)$ was represented for a general graph G, that is free from an induced subgraph isomorphic to claw $K_{1,3}$ [1]. A bipartite graph G has an induced subgraph isomorphic to $K_{1,3}$ if the maximum degree $\triangle(G) \geq 3$ so that $\gamma(G)$ is not necessarily equal to $i(G)$.

For a graph G, a subgraph I is defined as two adjacent vertices v and w in $V(G)$ and its neighbors such that the degrees on I satisfy $d_I(v) \geq 3$ and $d_I(w) \geq 3$. In this paper, v and w are called core vertices. We observe that I is a forbidden subgraph for $\gamma(G) = i(G)$ with a simplest proof. A property of I is remarkable for dominating sets of a graph. It characterizes 3-connected graphs, all of which are arranged by contracting edges between core vertices [2], where the independent domination number and the domination number are significantly different [3] by existence of I. We have a different approach to the domination number formulation. A bipartite graph G is decomposed by a vertex set I, which is $G = I_1 \cup \cdots \cup I_k \cup F$ pairwise disjoint. Obviously, $\gamma(G_1 \cup G_2) \leq \gamma(G_1) + \gamma(G_2)$ for arbitrary graphs G_1 and G_2. On the basis of it, we present a sufficient condition led to an equation $\gamma(G) = \gamma(I_1) + \cdots + \gamma(I_k) + \gamma(F) = 2k + i(F)$ as a main theorem. The k-dominating graph $D_k(G)$ explains the proof of the theorem. It is defined by a vertex set in which a vertex is corresponding to a dominating set of G with the cardinality at most k and an edge set of vertex pairs which differ by either adding or deleting a single vertex of corresponding dominating sets. For any non-trivial bipartite graph G, $D_{\Gamma(G)+1}(G)$ is connected [6], so a sequence of minimal dominating sets is a factor.

The independent domination number of a bipartite graph is led in a certain case. The equivalency of $i(G) = |V|/2$ for a bipartite graph G was shown in [4]. From the proof, $i(G)$ is generally formulated with variants represented on a partition by complete bipartite graphs.

The domination number of a bipartite graph is related to a compactness of a topological space. The graphical representation of an instance of the minimum cover problem is a bipartite graph which solves the domination number with the use of statements in this paper.

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Stirling, Bell and Fubini numbers for graphs

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B. Duncan and R. Peele defined Stirling numbers of the second kind and Bell numbers for graphs. In our talk, we give an extensive study of them, furthermore, we introduce and investigate Fubini numbers for graphs. For special graphs, they give back the ordinary, nonconsecutive and r-generalized variants of these numbers.

(This is a joint work with Zsófia Kereskényi-Balogh.)

Edge colorings and forbidden rainbow stars

KNUT ODERMANN (JOINT WORK WITH HANNO LEFMANN AND CARLOS HOPPEN)

TU Chemnitz

Given a number r of colors and a fixed r-edge-colored graph F, consider the problem of determining those n-vertex graphs G that admit the largest number of edge colorings with r colors such that G does not contain a subgraph isomorphic to F that also has the same color pattern as F. We discuss the case where F is a star S_t that is rainbow-colored, that is, t different colors are used to color its edges. It turns out that the number of edge colorings with $r \geq t$ colors and no rainbow-colored star S_t as a subgraph is maximized for $G = K_n$, for all large enough n.

Minimum degrees of minimal Ramsey graphs and hypergraphs

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A (uniform hyper-)graph G is called H-Ramsey if no matter how one colors its edges red/blue, there is a monochromatic copy of H. We say that G is minimal H-Ramsey if G is H-Ramsey, but no proper subgraph of it is. Burr, Erdős and Lovász studied the smallest minimum degree among all minimal K_t-Ramsey graphs and showed that it equals $(t-1)^2$. We discuss generalizations of their result to more colors and to hypergraphs.

Joint work with Dennis Clemens, Jacob Fox, Andrey Grinshpun, Anita Liebenau and Tibor Szabó.

Characterizing edges in graphs regarding the two-edge connected reliability

MANJA REINWARDT

Hochschule Mittweida

We analyse the two-edge connected reliability for a probabilistic graph with stochastically independently failing edges, which is defined as the probability that the graph is two-edge connected. When computing this reliability, the edges of the graph can be characterized in a certain way. Some edges may be deleted without changing the reliability. These are called irrelevant edges. Essential edges on the other hand are those whose deletion results in a vanishing reliability. The talk will deal with sufficient and necessary conditions for irrelevant edges and how they are related to essential edges.

Absolute algebraic connectivity of double brooms

SEBASTIAN RICHTER

Technische Universität Chemnitz, Fakultät für Mathematik

The absolute algebraic connectivity of a graph $G = (V, E)$ is defined as the maximum of algebraic connectivities for all nonnegative valuations on edges of G whose values sum up to $|E|$. We use a geometric technique based on embeddings of graphs to provide an explicit formula for the absolute algebraic connectivity of double brooms.

On the Periodicity of Partial Words

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Fine and Wilf (Proc. Am. Math. Soc. 16 (1965) 109-114) showed that every word of length at least $p + q - 1$ that is p- and q-periodic for two coprime positive integers p and q, is constant. Several authors studied versions of this classical result for partial words, which are words that may contain the symbol $\diamond$ meaning that the corresponding letter is unknown. We establish two conjectures posed by Blanchet-Sadri et al. (Inf. Comput. 206 (2008) 676-693) in this context. Furthermore, we provide short and simple proofs for several known results.

Extremal combinatorics in random discrete structures

MATHIAS SCHACHT

Universität Hamburg

We survey on recent results at the intersection of *extremal combinatorics* and *random graph theory*. More precisely, we consider thresholds for extremal properties of random discrete structures. Among other problems, we shall discuss the threshold for Szemerédi's theorem on arithmetic progressions in random subsets of the integers and the threshold for Turán-type problems for random graphs and hypergraphs, which were obtained independently by Conlon and Gowers and by the speaker. Furthermore, we discuss recent general results on independent sets in hypergraphs by Balogh, Morris and Samotij and by Thomason and Saxton, which led to new proofs of these results and already had have many other applications in the area.

3-Colouring graphs without triangles or induced paths on seven vertices

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The computational complexity of the k-colouring problem is among the most prominent topics in algorithmic graph theory. A notoriously difficult case is that of 3-colouring P_t-free graphs, that is, graphs that do not contain the t-vertex path as an induced subgraph. It is not known whether or not there exists any t such that 3-colouring is NP-complete on P_t-free graphs. Randerath and Schiermeyer gave a polynomial time algorithm for 3-colouring P_6-free graphs. Recently, Chudnovsky, Maceli, and Zhong extended this result to 3-colouring P_7-free graphs. They divide the algorithm into two cases: graphs containing a triangle, and triangle-free graphs. Their algorithm for the triangle-free case is quite involved and has a running time of $O(n^{18})$.

We describe an algorithm that solves the 3-colouring problem for $\{P_7$,triangle$\}$-free graphs in $O(n^7)$, developed independently of the algorithm by Chudnovsky et al.

Chromatic number of P_5-free graphs

INGO SCHIERMEYER

TU Bergakademie Freiberg

In this talk we study the chromatic number of P_5-free graphs.
In 1998, Reed proposed the following Conjecture which gives, for any graph G, an upper bound for the chromatic number $\chi(G)$ in terms of the clique number $\omega(G)$ and the maximum degree $\Delta(G)$.
Conjecture(Reed's conjecture)
Every graph G satisfies $\chi(G) \leq \lceil \frac{\omega(G)+\Delta(G)+1}{2} \rceil$.
Reed's conjecture is still open in general. Our main result is that the conjecture holds asymptotically for P_5-free graphs.
Theorem For every fixed $\omega \geq 3$ there exists $n(\omega)$ such that if G is a connected P_5-free graph of order $n \geq n(\omega)$ and clique number ω, then $\chi(G) \leq \lceil \frac{\omega(G)+\Delta(G)+1}{2} \rceil$.

Characteristic properties of the ruled surface with Darboux frame in $\mathbb{E}^3$

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In this study, the ruled surface with Darboux frame is defined. Then, the ruled surfaces characteristic properties which are related to the geodesic curvature, the normal curvature and the geodesic torsion are investigated. The relation between the Darboux frame and the Frenet frame on the ruled surface is presented.

The Stanley Depth in the Upper Half of the Koszul Complex

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Let $R = K[X_1, \ldots, X_n]$ be a polynomial ring over some field K. The Stanley depth of an R-module M is a combinatorial invariant coming from certain decompositions. We show that the k-th syzygy module of the residue class field K of R has Stanley depth $n-1$ for $\lfloor n/2 \rfloor \leq k < n$, as it had been conjectured by Bruns et. al. in 2010. In particular, this gives the Stanley depth for a whole family of modules whose graded components have dimension greater than 1. So far, the Stanley depth is known only for a few examples of this type. Our proof consists in a close analysis of a matching in the Boolean algebra.

Nonrepetitive Colourings of Lexicographic Products of Graphs

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The *lexicographic product* or graph composition $G \circ H$ *of graphs* G *and* H is a graph such that the vertex set of $G \circ H$ is the Cartesian product $V(G) \times V(H)$ and any two vertices (u, v) and (x, y) are adjacent in $G \circ H$ if and only if either u is adjacent with x in G or $u = x$ and v is adjacent with y in H.
Let G be a simple graph and let φ be a proper colouring of its vertices, $\varphi : V(G) \to \{1, \ldots, k\}$. We say that φ is *non-repetitive* if for any simple path on vertices $v_1 \ldots v_{2n}$ in G the associated sequence of colours $\varphi(v_1) \ldots \varphi(v_{2n})$ is not a repetition. The minimum number of colours in a non-repetitive colouring of a graph G is the *Thue chromatic number* $\pi(G)$. For the case of list-colourings let the *Thue choice number* $\pi_{ch}(G)$ of a graph G denotes the smallest integer k such that for every list assignment $L : V(G) \to 2^{\mathbb{N}}$ with minimum list length at least k, there is a colouring of vertices of G from the assigned lists such that the sequence of vertex colours of no path in G forms a repetition.
In our research we deal with the problem to find the minimum number of colours that can be used to colour all vertices of an arbitrary graph such that the obtained colouring is non-repetitive. Here we give some upper bounds for the Thue chromatic number of the lexicographic product of arbitrary graphs and demonstrate the tightness of the bounds by some examples. We also show that there exist families of graphs where the Thue chromatic number and the Thue choice number are the same.

Competition graphs of products of digraphs

MARTIN SONNTAG

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(joint work with HANNS-MARTIN TEICHERT, Universität zu Lübeck)

If $D = (V, A)$ is a digraph, its *competition graph (with loops)* $CG^l(D)$ has the vertex set V and $\{u, v\} \subseteq V$ is an edge of $CG^l(D)$ iff there is a vertex $w \in V$, such that $(u, w), (v, w) \in A$. In $CG^l(D)$, loops $\{v\}$ are allowed only if v is the only predecessor of a certain vertex $w \in V$. For several products $D_1 \circ D_2$ of digraphs D_1 and D_2, we investigate the relations between the competition graphs of the factors D_1, D_2 and the competition graph of their product $D_1 \circ D_2$.

On coloring of double disk graphs

ROMAN SOTÁK
P.J. Šafárik University, Košice, Slovakia

The coloring of disk graphs is motivated by the frequency assignment problem. In 1998, Malesińska et al. introduced double disk graphs as a generalization of disk graphs. They showed that the chromatic number of a double disk graph G is at most $33\omega(G) - 35$, where $\omega(G)$ denotes the size of a maximum clique in G. In 2004, Du et al. improved the upper bound to $31\omega(G) - 1$.
In this talk we establish a new upper bound, namely we show that the chromatic number of G is at most $15\omega(G) - 14$. We also discuss a tightness of this bound using our approach.

This is joint work with Jaka Kranjc, Borut Lužar and Martina Mockovčiaková.

Class 1 bounds for planar graphs

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We study the edge-chromatic number of planar graphs. There are planar class 2 graphs with maximum vertex-degree Δ, for each $\Delta \in \{2, 3, 4, 5\}$, and there are no planar graph class 2 graphs with $\Delta \geq 7$. Vizing [1965] conjectured that every planar graph with $\Delta \geq 6$ is a class 1 graph.
Let $\overline{F}(G)$ be the average face degree, and $F^*(G)$ be the local average face dregree of a planar graph G. The paper studies bounds b, b^* such that if $\overline{F}(G) \geq b$ or $F^*(G) \geq b^*$, then G is a class 1 graph. For $k \leq 5$ our results give insights into the structure of planar class 2 graphs with $\Delta = k$, and the results for $k = 6$ give support for the truth of Vizing's planar graph conjecture for $\Delta = 6$.

Reduced words in reflections in Coxeter groups

PATRICK WEGENER

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For a Coxeter system (W, S) the set of reflections is given by $T = \cup_{w2W} wSw^{-1}$. The elements of T are also generators of W. It is a classical question of combinatorial group theory to ask for reduced words in T. In my talk I will answer this question at least for parabolic Coxeter elements by using an action of the braid group on the set of reduced words for a parabolic Coxeter element. This action is transitive and hence the orbit of one reduced word yields all possible reduced words. (This is joint work with B. Baumeister, M. Dyer and C. Stump.)

On bounding the maximum degree by a function on a monotone graph parameter

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We say that a graph parameter φ is a monotone graph parameter if for all induced subgraphs H of a graph G, $\varphi(H) \leq \varphi(G)$ holds. For example, the maximum degree Δ, the chromatic number χ and the clique number ω are monotone graph parameters. It is well known that for every graph, $\omega \leq \chi \leq \Delta + 1$ holds. Gyárfás introduced hereditary graph classes where every graph complies with $\chi \leq f(\omega)$, where f is a monotonically increasing function. We are interested in a question of similar nature: What is the largest hereditary graph class $\mathcal{G}$ such that for all $G \in \mathcal{G}$, $\Delta(G) \leq f(\varphi(G))$ holds? We answer this question by a characterization of the minimal forbidden induced subgraphs of $\mathcal{G}$ and subsequently focus on the cases where $\varphi = \omega$ and $\varphi = \chi$.

An On-line Competitive Algorithm for Coloring P_8-free Bipartite Graphs

VEIT WIECHERT

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The existence of an on-line competitive algorithm for coloring bipartite graphs remains a tantalizing open problem. So far there are only partial positive results for bipartite graphs with certain small forbidden graphs as induced subgraphs, in particular for P_7-free bipartite graphs. We propose a new on-line competitive coloring algorithm for P_8-free bipartite graphs. Our proof technique improves the result, and shortens the proof, for P_7-free bipartite graphs.
Joint work with Piotr Micek.