Igor Fabrici, Stanislav Jendroľ, Gabriel Semanišin ed.

Czech - Slovak Conference
GRAPHS 2004

May 23–28, 2004   Vyšné Ružbachy

http://www.science.upjs.sk/csgt2004/index_eng.html

Preface

Welcome to the Czech-Slovak Conference on Combinatorics and Graph Theory 'GRAPHS 2004'.

The history of the Czech and Slovak graph-theoretical conferences dates back to 1961, when the first meeting, containing a section on Combinatorics and Graph Theory, took place at Liblice. Since 1969, the Czechoslovak (from 1993 Czech-Slovak) conferences on Combinatorics and Graph Theory have been held annually. Once in eight years, this conference becomes an international symposium, co-organized by all main Czech and Slovak Graph Theory centers, that is a follow-up to the famous first international conference in Smolenice in 1963.

The 2004 conference is organized by the Institute of Mathematics, Faculty of Science, Pavol Jozef Šafárik University in Košice and Union of Slovak Mathematicians and Physicists, branch Košice. The conference is held at Vyšné Ružbachy, on 23–28 May 2004. Vyšné Ružbachy is situated in the northeastern part of Slovakia and belongs to the most important Slovak spas. It is widely known because of its sources of thermal mineral water and a famous volcanic lake called Kráter.

The scientific program of the conference consists of 50 min lectures of invited speakers and of 20 min contributed talks presented by other participants. This booklet contains abstracts of invited lectures and contributed talks as were sent to us by the authors. Conference languages are English, Slovak and Czech.

Invited speakers:

Dalibor Fronček,	University of Minnesota, Duluth, USA
Geňa Hahn,	University of Montreal, Montreal, Canada
Pavol Hell,	Simon Fraser University, Burnaby, Canada
Mirka Miller,	University of Ballarat, Ballarat, Australia
Alexander Rosa,	McMaster University, Hamilton, Canada
Zdeněk Ryjáček,	University of West Bohemia, Plzeň, Czech Republic
Ladislav Stacho,	Simon Fraser University, Burnaby, Canada
Jozef Širáň,	Slovak University of Technology, Bratislava, Slovakia

We wish all participants a pleasant and fruitful stay at Vyšné Ružbachy.

Organising committee:

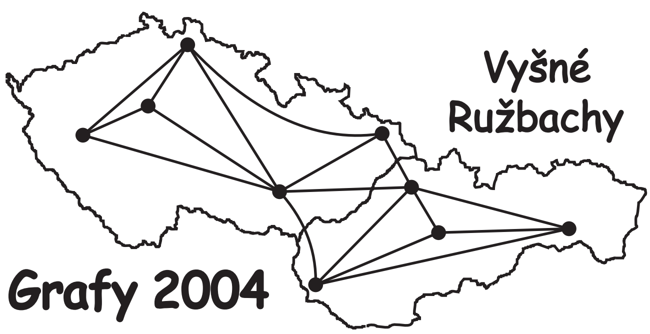
Igor Fabrici
Stanislav Jendroľ (chair)
Štefan Schrötter
Gabriel Semanišin

Contents

History

A list of all previous Czechoslovak (from 1993 Czech-Slovak) conferences on Combinatorics and Graph Theory.

1961	Liblice
1963	Smolenice (international)
1966	Smolenice
1969	Smolenice
1970	Modra
1971	Zlatá Idka
1972	Štiřín
1973	Staré Splavy
1974	Praha (international)
1975	Brno
1976	Smolenice
1977	Jenišov
1978	Zemplínska Šírava
1979	Nová Ves u Branžeže
1980	Pardubice
1981	Jablonec nad Nisou
1982	Praha (international)
1983	Zemplínska Šírava
1984	Kočovce
1985	Luhačovice
1986	Račkova dolina
1987	Domažlice
1988	Lazy pod Makytou - Čertov
1989	Hrubá Skála
1990	Prachatice (international)
1991	Zemplínska Šírava
1992	Donovaly
1993	Janov nad Nisou
1994	Brno
1995	Herľany
1996	Soláň Čarták
1997	Chudenice
1998	Praha (international)
1999	Kočovce
2000	Liptovský Trnovec
2001	Sedmihorky
2002	Rejvíz
2003	Javorná



Cayley maps on surfaces with boundary

Marcel Abas

Cayley maps are embeddings of Cayley graphs in orientable surfaces without boundary such that the cyclic local rotation of generators at each vertex is the same. In our contribution we will consider more general embeddings of Cayley graphs, allowing surfaces to be nonorientable as well and allowing boundary components.

Edge-antimagic total labelings of graphs

Martin Bača

For a graph $G = (V, E)$, a bijection g from $V(G) \cup E(G)$ onto the integers $1, 2, ..., |V(G)| + |E(G)|$ is called (a, d)-edge-antimagic total labeling of G if the edge-weights $w(xy) = g(x) + g(y) + g(xy)$, $xy \in E(G)$, form an arithmetic progression with initial term a and common difference d. An (a, d)-edge-antimagic total labeling will be called super (a, d)-edge-antimagic total if it has the property that the vertex-labels are the integers $1, 2, ..., |V(G)|$, the smallest possible labels. We will present super (a, d)-edge-antimagic total labelings for some families of graphs.

On antipodes in hypercubes

Rostislav Caha

(joint work with Václav Koubek)

In the talk will be presented some results and problems on finding paths with given length in hypercubes. Some lower and upper bounds for the problem of finding the shortest connecting paths for n antipodes will be shown.

The crossing number of products of 6-vertex trees with cycles

Emília Draženská

The crossing number of a graph G is the minimum number of edge crossings in any drawing of G in the plane. The crossing numbers of Cartesian products of all four-vertex graphs with cycles and with paths are determined. There are known crossing numbers of all Cartesian products of graphs of order five with paths and several results of products with cycles. We summarize crossing numbers of Cartesian products of cycles and trees on six vertices.

Unavoidable configurations in outerplanar graphs

Igor Fabrici

Every 2-connected outerplanar graph of order at least k ($k \geq 3$) contains a path on k vertices with all vertices of degree at most $k+3$ and a path on k vertices with degree sum at most $4k-2$.

Every 2-connected outerplanar graph without adjacent vertices with degree sum at most 5 contains a triangle C_3 with vertices of degrees 2, 4 and b, $4 \leq b \leq 6$, and a 3-star $K_{1,3}$ with central vertex of degree 4 and remaining vertices of degrees 2, 2 and b, $4 \leq b \leq 6$. Moreover, all bounds are best possible.

Subchromatic index - properties and complexity

Jiří Fiala

(joint work with Van Bang Le)

In an edge coloring of a graph, each color class forms a subgraph without path of length two (a matching). An edge subcoloring generalizes this concept: Each color class in an edge subcoloring forms a subgraph without path of length three. While every graph with maximum degree at most two is edge 2-subcolorable, we point out in this paper that recognizing edge 2-subcolorable graphs with maximum degree three is NP-complete, even when restricted to triangle-free graphs. As by-products, we obtain NP-completeness results for the star index and the subchromatic number for several classes of graphs. It is also proved that recognizing edge 3-subcolorable graphs is NP-complete.

Moreover, edge subcolorings and subchromatic index of various basic graph classes are studied. In particular, we show that every unicyclic graph is edge 3-subcolorable and edge 2-subcolorable unicyclic graphs have a simple structure, allowing an easy linear time recognition.

Incomplete and non-compact round robin tournaments

Dalibor Fronček

(joint work with Mariusz Meszka, Petr Kovář, and Tereza Kovářová)

Most hockey fans (at least all Czech ones) would probably agree that the current format of the World Championship is not good. Therefore, we can imagine a situation when the International Ice Hockey Federation tries yet another model of the championship. As they want to preserve the current number of teams and games, they decide to play two qualifying groups with 8 teams in each of them. However, because a complete tournament would take too long, they decide that each team plays just 5 games rather than 7. One group consists of Slovakia, Czech Republic, Sweeden, Russia, France, Denmark, Japan, and Ukraine. The games that are **not** to be played include Slovakia–France, Slovakia–Japan, Russia–Sweeden and Russia–Czech Republic. We can see that this schedule is not fair, because Russia plays just one tough game against Slovakia while Slovakia plays all the strongest teams. We will show how to avoid such a situation and make an incomplete tournament as fair as possible. The solution is actually a nice application of certain type of graph labeling, namely vertex-magic vertex labeling.

On the other hand, we can consider complete round robin tournaments that are scheduled in a bit unusual way. Many sports competitions are played as 2-leg round robin tournaments with $2n$ teams. These tournaments are typically scheduled in such a way that a schedule for a 1-leg tournament is repeated twice. By a *round* we mean a collection of games in which each team plays at most one game. A team that does not play a game in a particular round is said to have a *bye* in that round.

The home and away games of every team should interchange as regularly as possible provided that each team meets every opponent once at its own field and once at the opponent's field. The best *home-away pattern* (HAP) is indeed one with no two consecutive home or away games (called a *break* in the schedule). Obviously, we can never find a compact schedule for $2n$ teams with no breaks—in this case the teams that start the season with a home game would never meet. Therefore, looking at HAPs, the best schedule is one with the minimum number of breaks. This number in a 1-leg round robin tournaments is $2n - 2$, as proved by de Werra.

We will show that if each team has exactly one bye, then we can construct schedules with no breaks, and that these schedules are unique.

Cops, robbers and graphs

Geňa Hahn

We survey some old and new results on cops-and-robbers games on graphs and digraphs, with a host of open problems.

Proper interval graphs and bigraphs

Pavol Hell

These two well structured classes of graphs have recently seen renewed interest, because of their applications, because of the many different concepts equivalent to them (especially to the proper interval bigraphs), and also because of new algorithm techniques found applicable to their recognition. I will discuss these new developments, with focus on lexicographic breadth first search and on certifying algorithms. This is joint work with Huang Jing, and will also include recent results of Derek Corneil and of Rich Lundgren and his students.

Randomly $2C_n$ graphs

Pavel Híc

(joint work with Milan Pokorný)

Let G be a graph containing a subgraph H without isolated vertices. In [2] the concept of "randomly H graphs" is defined as follows: We call G a *randomly H graph* if any subgraph of G without isolated vertices which is isomorphic to a subgraph of H can be extended to a subgraph H_1 of G such that H_1 is isomorphic to H. Every nonempty graph is randomly K_2, and also every graph G without isolated vertices is randomly G graph. Further, every K_n is a randomly H graph for every subgraph $H \subset K_n$. The general question here is for what classes of graphs H it is possible to characterize all those graphs G that are randomly H graphs. In [1] Alavi, Lick, and Tian characterized the complete n-partite graphs. In [2] Chartrand, Oelermann, and Ruiz characterized graphs that are randomly C_n ($n \geq 3$). Here we give a characterisation of graphs which are randomly $2C_n = C_n \cup C_n$ ($n \geq 3$).

References

[1] Alavi, Y. - Lick, D. R. - Tian, S.: Randomly complete n-partite graphs, Math. Slovaca 39 (1989), 241–250.

[2] Chartrand, G. - Oellermann, O. - Ruiz, S.: Randomly H graphs, Math. Slovaca 36 (1986), 129–136.

Minimal eccentric sequences with two values

Pavel Hrnčiar
(joint work with Gabriela Monoszová)

A sequence of positive integers is called *eccentric* if there is a graph which realizes considered sequence as the sequence of the eccentricities of its vertices. An eccentric sequence is called *minimal* if it has no proper eccentric subsequence with the same number of distinct eccentricities.

Theorem *There are exactly 7 minimal eccentric sequences of type* $4^\alpha, 5^\beta$*, namely* $4^7, 5^2$; $4^6, 5^4$; $4^5, 5^6$; $4^4, 5^8$; $4^3, 5^9$; $4^2, 5^{12}$; $4, 5^{14}$.

We present a conjecture about all minimal eccentric sequences of type $r^\alpha, (r+1)^\beta$.

An upper bound on the size of the smallest trivalent regular maps of prime face length and of large planar width

Mária Ipolyiová

The planar width of a finite, non-spherical map is the smallest number of intersections of a non-contractible closed curve on the supporting surface of the map with the embedded graph. Using a method based on spectral norms of matrices we improve the existing upper bounds on the smallest trivalent regular map of a given prime face length q the planar length of which is larger than a given number r.

Vertex-transitive graphs: A survey of methods and problems

Robert Jajcay

Vertex-transitive graphs have a large number of applications, their study includes a wide variety of methods from many different areas, and there is a considerable number of open problems associated with this area that are both interesting and hard.

Our presentation is a highly personal account of some of the most recent developments in the area that the presenter has been involved with or at least finds worth pursuing. The talk will contain many open problems and very few answers.

On list chromatic number of cartesian product of two graphs

Stanislav Jendroľ

(joint work with Mieczysław Borowiecki and Jozef Miškuf)

Given a graph G and an assignment $\mathcal{L} = \{L(v) \mid v \in V(G)\}$ of lists of admissible colors for its vertices, we say that G is *$\mathcal{L}$-list colorable* if the vertices of G can be properly colored (i.e., adjacent vertices receive distinct colors) so that each vertex v is colored with a color from $L(v)$. If all list of $\mathcal{L}$ have the same size k, $\mathcal{L}$ is called a k-assignment. The minimum integer k such that G is $\mathcal{L}$-list colorable for every k-assignment $\mathcal{L}$ is called the *list chromatic number* of G (or the *choice number* of G) and is denoted by $\chi_\ell(G)$.

First two authors conjectured that for any two graphs G and H there holds $\chi_\ell(G \times H) \leq \max\{\chi_\ell(G), \chi_\ell(H)\} + 1$. We show that the conjecture is true if one of graphs G or H is a tree. We also prove that for every two graphs G, H there is

$$\chi_\ell(G \times H) \leq \min\{\chi_\ell(G) + \mathrm{col}(H), \chi_\ell(H) + \mathrm{col}(G)\} - 1.$$

Here $\mathrm{col}(K) = \max\{\delta(F) + 1 : F \subseteq K\}$.

A revival of the Girth Conjecture

Tomáš Kaiser

(joint work with Daniel Kráľ and Riste Škrekovski)

The Girth Conjecture of Jaeger and Swart states that every bridgeless cubic graph of sufficiently large girth is 3-edge-colorable. Although it has turned out to be false, we show that in a way, its analogue for the circular chromatic index (in place of the ordinary chromatic index) is true. The result generalizes to a Vizing-type theorem for the circular edge-coloring: For any $\varepsilon > 0$, the circular chromatic index of all graphs with maximum degree Δ and sufficiently large girth is less than $\Delta + \varepsilon$.

Homotopy classes of prime 3-manifolds of genus ≤ 2

Ján Karabáš

(joint work with Roman Nedela)

Present paper deals with fundamental groups of 3-manifolds represented by a certain family $\mathcal{S}$ of bipartite 4-edge-coloured graphs. List of fundamental groups of prime 3-manifolds of genus at most two represented by graphs in $\mathcal{S}$ with at most 42 vertices is produced.

Theorem *There are 97 isomorphism classes of fundamental groups of prime 3-manifolds of genus at most two represented by admissible 6-tuples of complexity at most 21. One 6-tuple represents a homotopy sphere, 17 represent lens spaces, 71 represent prime 3-manifolds with finite homology groups and 8 represent prime 3-manifolds with infinite homology groups.*

Octahedral fulleroids

František Kardoš

(joint work with Stanislav Jendroľ)

We present some properties of polyhedral maps with two types of faces only (fulleroids) and with full octahedral symmetry. We give sufficient and necessary condition for existence of such objects depending on type of faces either by finding at least one example to prove existence or proving nonexistence using some symmetry invariants.

Counting noncrossing graphs

Martin Klazar

A graph $G = (V, E)$, where $V \subset \{1, 2, \ldots\}$, is noncrossing if for no four vertices $a < b < c < d$ in V we have two (crossing) edges $\{a, c\}$ and $\{b, d\}$. In my talk I will discuss results and problems connected with enumeration of noncrossing graphs.

Small crossing numbers of derived line graphs

Marián Klešč

The crossing number $cr(G)$ of a graph G is the minimum possible number of edge crossings in a drawing of G in the plane. There are very few classes of graphs for which the crossing numbers are known exactly.

Let G be a connected graph with vertex set V and edge set E. $L(G)$ is the line graph of G if there exists one-to-one correspondence between $E(G)$ and $V(L(G))$ such that two vertices of $L(G)$ are adjacent if and only if the corresponding edges of G are adjacent. There is the complete characterization of graphs whose line graphs have crossing number one. For planar graphs there are known the necessary and sufficient conditions to have a line graph with crossing number two.

Let us suppose two special graphs derived from line graphs. Concrete, let $L^*(G)$ be the graph obtained from $L(G)$ by adding a new vertex corresponding to each cut-vertex of G and the edges joining this new vertex with the vertices which correspond to the edges of G incident with the considered cut-vertex. Let $L^{**}(G)$ be the graph obtained from $L^*(G)$ by adding new edges joining the vertices of $L^*(G)$ correspond to adjacent cut-vertices of the graph G.

It is the purpose of our talk to give the characterization of graphs G for which $L^*(G)$ and $L^{**}(G)$ are nonplanar and have small crossing number.

Distance independent domination in iterated line graphs

Martin Knor

(joint work with Ľudovít Niepel)

Let $k \geq 1$ be an integer and let $G = (V, E)$ be a graph. A set S of vertices of G is k-independent if the distance between any two vertices of S is at least $k + 1$. We denote by $\rho_k(G)$ the maximum cardinality among all k-independent sets of G. Number $\rho_k(G)$ is called the k-packing number of G. Furthermore, S is defined to be k-dominating set in G if every vertex in $V(G) - S$ is at distance at most k from some vertex in S. A set S is k-independent dominating if it is both k-independent and k-dominating. The k-independent dominating number, $i_k(G)$, is the minimum cardinality among all k-independent dominating sets of G. We find the values $i_k(G)$ and $\rho_k(G)$ for iterated line graphs.

Decomposition of plane graphs into closed trails

Zuzana Kocková

(joint work with Mirko Horňák)

Let G be a graph and let $\mathrm{Lct}(G)$ denote the set of all integers $l \geq 3$ such that there is a closed trail of length l in G. A simple connected even graph G (all its vertices are of even degree) is said to be *arbitrarily decomposable into closed trails* (ADCT) if for any sequence $(l_1, \ldots, l_p)$ such that $l_i \in \mathrm{Lct}(G)$, $i = 1, \ldots, p$, and $\sum_{i=1}^{p} l_i = |E(G)|$, there exists a sequence $(T_1, \ldots, T_p)$ of edge-disjoint closed trails T_i of length l_i, $i = 1, \ldots, p$. Let G be a simple 4-connected plane graph. We prove that if G is ADCT, then $E(G)$ contains at most eight edges e such that both faces incident with e are of degrees at least 4.

Closure for the property of having a hamiltonian prism

Daniel Kráľ

(joint work with Ladislav Stacho)

The prism of a graph G is the graph obtained from two disjoint copies of G by adding edges between the corresponding pairs of vertices. We prove that the prism of a graph G of order n is hamiltonian if and only if the prism of the graph $\mathrm{Cl}_{4n/3-4/3}(G)$ is hamiltonian where $\mathrm{Cl}_{4n/3-4/3}(G)$ is the graph obtained from G by sequential adding edges between non-adjacent vertices whose degree sum is at least $4n/3 - 4/3$. In addition, we show that the threshold $4n/3 - 4/3$ cannot be improved to more than $4n/3 - 5$.

Factorizations of complete graphs into caterpillars of diameter 5 with at least one vertex of degree 2

Michael Kubesa

A tree R such that after deleting all leaves we obtain a path P is called a *caterpillar*. The path P is called the *spine* of the caterpillar R. If the spine has length 3 and R on $2n$ vertices contains vertices of degrees $r, s, t, 2$, where $2 < r, s \leq n$ and $2 \leq t \leq n$, then we say that R is an $[r, s, t, 2]$-*caterpillar* of diameter 5 or a *caterpillar of diameter* 5 *with at least one vertex of degree* 2. We completely characterize $[r, s, t, 2]$-caterpillars of diameter 5 on $4k + 2$ vertices that factorize K_{4k+2}.

Exponents of one-vertex maps and t-balanced maps

Ľubica Líšková

A Cayley map is a Cayley graph embedded in an oriented surface in such a way that the cyclic order of generators is the same at each vertex. An exponent of a Cayley map is a number e with the property that (loosely speaking) the Cayley map is isomorphic to its *e-fold rotational image*. Cayley maps for the trivial group are important since each Cayley map is a regular lift of a one-vertex Cayley map.

In our contribution we present results on exponents of one-vertex maps, with emphasis on maps exhibiting certain types of 'balance' in the distribution of generators and their inverses.

Fano colourings of cubic graphs and the Fulkerson Conjecture

Edita Máčajová

(joint work with Martin Škoviera)

A Fano colouring is a colouring of the edges of a cubic graph by points of the Fano plane such that the colours of any three mutually adjacent edges form a line of the Fano plane. It has recently been shown by Holroyd and Škoviera (J. Combin. Theory Ser. B, to appear) that a cubic graph has a Fano colouring if and only if it is bridgeless. We show that six, and conjecture that four, lines of the Fano plane are sufficient to colour any bridgeless cubic graph. We establish connections of our conjecture to other conjectures concerning bridgeless cubic graphs, in particular to the well-known conjecture of Fulkerson about the existence of a double covering by 1-factors in every bridgeless cubic graph.

Two variations on Franklin's theorem

Tomáš Madaras

In 1922, P. Franklin proved that each plane triangulation of minimum degree 5 contains a 5-vertex adjacent to ≤ 6-vertices (that is, a 3-path of the type $(\leq 6, 5, \leq 6)$ and weight ≤ 17). We show, in addition, that each 3-connected plane graph of minimum degree 5 contains an induced 3-path of weight ≤ 17 and, also, a 3-path of the type $(\leq 6, 5, \leq 6)$ such that the size of all neighboring faces is bounded above by 23; according to these results, we discuss the connections to light graphs theory and related open problems.

Additive and hereditary properties of systems of objects

Peter Mihók

We use the basic elementary notions of category theory. A concrete category **C** is a collection of *objects* and *arrows* called *morphisms*. An object in a concrete category **C** is *a set with structure*. We will denote the *ground-set* of the object A by $V(A)$. The morphism between two objects is a *structure preserving mapping*. Obviously, the morphisms of **C** have to satisfy the axioms of the category theory. The natural examples of concrete categories are: **Set** of sets, **FinSet** of finite sets, **Graph** of graphs, **Grp** of groups, **Poset** of partially ordered sets with structure preserving mappings, called homomorphisms of corresponding structures.

Let **C** be a concrete category. A *simple system of objects* of **C** is an ordered pair $S = (V, E)$, where $E = \{A_1, A_2, \ldots, A_m\}$ is a finite set of the objects of **C**, such that the ground-set $V(A_i)$ of each object $A_i \in E$ is a finite set and $V \supseteq \bigcup_{i=1}^{m} V(A_i)$.

To generalize the results on generalized colourings of graphs to arbitrary simple systems of objects we need to define *isomorphism of systems*. Let $S_1 = (V_1, E_1)$ and $S_2 = (V_2, E_2)$ be two simple systems of objects of a given concrete category **C**. The systems S_1 and S_2 are said to be isomorphic if there is a pair of bijection:

$$\phi : V_1 \longleftrightarrow V_2; \qquad\qquad \psi : E_1 \longleftrightarrow E_2,$$

such that if $\psi(A_{1i}) = A_{2j}$ then $\phi/V(A_{1i}) : V(A_{1i}) \longleftrightarrow V(A_{2j})$ is an isomorphism of the objects $A_{1i} \in E_1$ and $A_{2j} \in E_2$ in the category **C**.

A property of object systems is any class of object systems closed under isomorphism. In our talk we will consider the structure of additive hereditary properties of object systems.

Moore bound and beyond: A survey of the degree/diameter problem

Mirka Miller

In this talk we will consider extremal graphs, both undirected and directed. For the optimisation, we deal with three parameters, namely, maximum degree Δ, order (= number of vertices) n and diameter D for undirected graphs; and maximum out-degree d, order n and diameter k for directed graphs (digraphs). Fixing any two of the three respective parameters, we wish to find the extreme values which can be attained in the third parameter.

To date, most research has been done on the problem of maximising the order of a graph, resp. digraph, the so-called

Degree/diameter problem: *Given natural numbers Δ and D, find the largest possible number of vertices $N(\Delta, D)$ in a graph of maximum degree Δ and diameter at most D.*

The statement of the directed version of the problem differs only in that 'degree' is replaced by 'out-degree'.

General upper bounds for the order are obtained by considering the maximum possible number of vertices in the spanning tree rooted at any vertex of a graph, resp. digraph; these bounds are called the *Moore bounds.* Since these bounds have been shown to be attainable only for certain special graphs and digraphs, much effort has been devoted to finding better (tighter) upper bounds for the maximum possible number of vertices, given the other two parameters, thus attacking the degree/diameter problem 'from above'. To attack the degree/diameter problem 'from below', we are interested in constructions which produce 'large' graphs, resp. digraphs, given the other two parameters.

This talk will give an overview of the current state of this problem and pose several open problems in the area.

Enumeration of unrooted maps with given genus

Roman Nedela

(joint work with Alexander Mednykh)

Let $\mathcal{N}_g(f)$ denote the number of rooted maps of genus g having f edges. Exact formula for $\mathcal{N}_g(f)$ is known for $g = 0$ (Tutte 1963), $g = 1$ (Arques 1987), $g = 2, 3$ (Bender and Canfield 1991). In the present paper we derive an enumeration formula for the number $\Theta_\gamma(e)$ of unrooted maps on an orientable surface S_γ of given genus γ and given number of edges e. It has a form of a linear combination $\sum_{i,j} c_{i,j}\mathcal{N}_{g_j}(f_i)$ of numbers of rooted maps $\mathcal{N}_{g_j}(f_i)$ for some $g_j \leq \gamma$ and $f_i \leq e$. The coefficients $c_{i,j}$ are functions of γ and e. Let us consider the quotient S_γ/Z_ℓ of S_γ by a cyclic group of automorphisms Z_ℓ as a two-dimensional orbifold O. The task to determine $c_{i,j}$ requires to solve the following two subproblems:

(a) to compute the number $Epi_o(\Gamma, Z_\ell)$ of order preserving epimorphisms from the fundamental group Γ of the orbifold $O = S_\gamma/Z_\ell$ onto Z_ℓ,

(b) to calculate the number of rooted maps on the orbifold O which lifts along the branched covering $S_\gamma \to S_\gamma/Z_\ell$ to maps on S_γ with the given number e of edges.

The number $Epi_o(\Gamma, Z_\ell)$ is expressed in terms of classical number theoretical functions. The other problem is reduced to the standard enumeration problem to determine the numbers $\mathcal{N}_g(f)$ for some $g \leq \gamma$ and $f \leq e$. It follows that $\Theta_\gamma(e)$ can be calculated whenever the numbers $\mathcal{N}_g(f)$ are known for $g \leq \gamma$ and $f \leq e$. In the end of the paper the above approach is applied do derive the functions $\Theta_\gamma(e)$ explicitly for $\gamma \leq 3$. Let us remark that the function $\Theta_\gamma(e)$ was known only for $\gamma = 0$ (Liskovets 1981). Tables containing the numbers of isomorphism classes of maps up to 30 edges for genus $\gamma = 1, 2, 3$ are produced.

Tracing locally constrained homomorphisms

Daniël Paulusma

(joint work with Jiří Fiala)

We introduce partial orderings on a family of graphs, in which a graph H is smaller than a graph G, if a locally constrained homomorphism from G to H exists. Then we are interested in the complexity of finding minimal elements. We prove that it is NP-complete to find out whether G allows a locally bijective homomorphism to a smaller graph H. We also show that it is NP-complete to find out whether G allows a locally surjective homomorphism to a smaller graph H. For locally injective homomorphisms we give a polynomial time algorithm that computes a minimal element for instance graph G.

Extended Petersen graphs

Alexander Rosa

We discuss some properties of yet another class of graphs whose smallest member is the famous Petersen graph. These graphs which we call *extended Petersen graphs* (not to be confused with generalized Petersen graphs) arise naturally in the context of a construction of Steiner systems S(2,4,v) with maximal arcs but seem to be quite interesting on their own. (Some of this is joint work with Peter Horák.)

Exclusive sum labeling

Joe Ryan

(joint work with Mirka Miller and Moris Tuga)

A graph $G(V,E)$ is called a *sum graph* if there is an injective labeling called *sum labeling* L from V to a set of positive integers S such that $xy \in E$ if and only if $L(w) = L(x) + L(y) \in S$. Then also w is called a *working vertex*. A sum labeling L is called *exclusive sum labeling* with respect to a subgraph H of G if the vertices of H are labeled in such a way that none of the vertices of H is a working vertex. Using exclusive sum labelings is (to date) the only known way of extending summable labelings to a general union of graphs.

We summarize known results on exclusive sum labeling and exclusive sum number for several classes of graphs. We conclude with a list of open problems.

Stability of graph properties

Zdeněk Ryjáček

A class of graphs $\mathcal{C}$ is said to be stable under a closure operation cl if $G \in \mathcal{C}$ implies $\mathrm{cl}(G) \in \mathcal{C}$. Let $\mathcal{C}$ be a stable class and $\mathcal{P}$ a property. We say that $\mathcal{P}$ is stable in $\mathcal{C}$ under cl, if, for any $G \in \mathcal{C}$, G has $\mathcal{P}$ if and only if $\mathrm{cl}(G)$ has $\mathcal{P}$. Similarly, a graph invariant π is stable in $\mathcal{C}$ under cl if $\pi(G) = \pi(\mathrm{cl}(G))$ for any $G \in \mathcal{C}$. Proving a stability result is usually the first step in applying closure techniques to a specific problem.

We survey known results on stability of graph properties and invariants under the closure operations based on local completions and on subgraph contractions. Applications of these results and some open questions will be discussed.

Numbers of edges in supermagic graphs

Andrea Semaničová

(joint work with Jaroslav Ivančo and Svetlana Drajnová)

A graph is called *supermagic* if it admits a labelling of the edges by pairwise different consecutive integers such that the sum of the labels of the edges incident with a vertex is independent of the particular vertex. In this talk we will deal with connection between number of vertices and number of edges in supermagic graphs. Let $M(n)$, $(m(n))$ denote the maximal (minimal) *number of edges in a supermagic graph* of order n. We will prove that there exists positive integer ε, $m(n) < \varepsilon < M(n)$ that every graph of order n and size ε is not supermagic. We will determine $M(n)$ and we will establish some bounds for $m(n)$.

Non-intersecting longest paths in strongly connected oriented graphs

Gabriel Semanišin

(joint work with Susan van Aardt)

One of the classical results of graph theory states that every two longest paths of a connected non-oriented graph have a vertex in common. The corresponding problem for three longest paths of an ordinary non-oriented graph is still unsolved. This question arose for the oriented case while studying the Directed Path Partition Conjecture. In general, the problem is simple, because one can easily construct an oriented graph having two non-intersecting longest paths.

But the situation is more interesting if we require the oriented graph to be strongly connected. We prove that for $k \leq 7$ there is no strongly connected oriented graph with non-intersecting longest paths of order k. For $k \geq 8$ we provide a construction of an infinite class of graphs with approximately $\sqrt{k}$ non-intersecting longest paths.

Maps of p-gons with a ring of q-gons

Roman Soták

(joint work with Róbert Hajduk and Tomáš Madaras)

Deza and Grishukin studied 3-valent maps $M_n(p,q)$ consisting of a ring of n q-gons whose inner and outer domains are filled by p-gons. They described the conditions for n, p, q under which such map may exist and presented several infinite families of them. The open cases are, in particular, $M_n(7,5)$ with $n > 28$, $M_n(5,7)$ with $n \in \{17,18,19\}$ and $M_n(5,q)$ for $q \geq 8$. We extend their results by presenting infinite families of new maps $M_n(7,5)$ and $M_n(5,q)$.

Graph traversal

Ladislav Stacho

Graph traversal is a fundamental problem in graph algorithms: Given a starting vertex, can we systematically traverse the entire graph reaching every vertex reachable from the starting one? Many elementary graph algorithms involve making traversal of the graph (e.g., connected component, tree and cycle detection, graph colouring) in order to update their knowledge as they visit each edge and vertex. The problem is easy when we have enough memory (to remember the vertices that have been already visited), but becomes complicated when we have only constant memory (so, we cannot remember all the visited vertices). There have been several studies on traversal in the literature.

In the first part of my talk, I will survey known results. In the second part, I will concentrate on traversal of planar graphs and will report on some recent results.

On some new types and kinds of polyhedra non-inscribability

Sergej Ševec

Types of polyhedra are studied that are non-inscribable in the spherical shell. A general sufficient condition is formulated. Employing it, a large class of polyhedra is proved to be spherical-shell non-inscribable in addition to those non-inscribable in the sphere. Several illustrations of applying the sufficient condition proved (as well as the proof techniques used) are presented on the examples of spherical-shell non-inscribability calculation for particular polyhedra types. In the second part of the paper, the relationship between (non-) inscribability in the spherical shell and (non-) inscribability in the sphere is focused and traced more closely. In consequence, a new kind of (non-) inscribability is defined, that interpolates these two ones.

One-vertex quotient genus of covalence sequences of Cayley maps

Jana Šiagiová

We consider covalence sequences of infinite, one-ended, 3-connected, planar Cayley maps. The one-vertex quotient genus of such a covalence sequence is the smallest genus of an orientable surface containing a one-vertex quotient of the corresponding Cayley map. In our contribution we present various results related to one-vertex quotient genera of covalence sequences.

Vertex-transitive maps

Jozef Širáň

Which vertex-transitive graphs can be embedded in surfaces in such a way that the *embedding* is vertex-transitive as well? Obviously, the automorphism group of such an embedding must be a subgroup of the full automorphism of the graph. Therefore it is natural to expect an answer in terms of existence of a suitable group of automorphisms of the graph. The aim of this talk is to make the answer precise, including a discussion on consequences and related topics.

Layout volumes of hypercubes

Ľubomír Török

(joint work with Imrich Vrťo)

We study 3-dimensional layouts of hypercubes in a 1-active layer and general model. The problem can be understood as a graph drawing problem in $3D$ space and was addressed at Graph Drawing 2003. In the 1-active layer model a vertex of degree d is represented by a square of side d and is placed in the bottom layer of the 3-dimensional grid. In the general model a vertex of degree d is represented as a cube of side d and can lie anywhere in the grid. Edges are drawn as nonoverlaping paths in the grid. The aim is to minimize the the occupied volume.

For both models we prove general lower bounds which relate volumes of layouts to a graph parameter cutwidth. Then we propose tight upper bounds on volumes of layouts of N-vertex hypercubes. Especially we have

$\mathrm{VOL}_{1-AL}(Q_{\log N}) = \frac{2}{3}N^{\frac{3}{2}}\log N + O(N^{\frac{3}{2}})$, for even $\log N$ and

$\mathrm{VOL}(Q_{\log N}) = 2\frac{6^{\frac{1}{2}}}{9}N^{\frac{3}{2}} + O(N^{\frac{4}{3}}\log N)$, for $\log N$ divisible by 3.

The 1-active layer layout can be easily extended to a 2-active layer (bottom and top) layout which improves a result presented at Graph Drawing 2003.

On vertices with at most one neighbour of large degree in planar graphs

Milan Tuhársky
(joint work with Stanislav Jendroľ and Tomáš Madaras)

It is well known that every planar graph G contains a vertex of degree at most 5. The *edge-weight* of an edge e, denoted by $ew(e)$, is defined as the sum of the degrees of the vertices incident with the edge e. Then the *edge-weight* of graph G is defined by $ew(G) = \min\{ew(e),\ e \in E(G)\}$. In this talk we will deal with the family of graphs with the edge-weight $ew(G) \geq 9$. We will prove that every 3-connected planar graph with $ew(G) \geq 9$ contains a vertex v of degree $d \in \{3, 4, 5\}$ such that at most one of the neighbour of the vertex v has unbounded degree.

On some packing and decomposition problems in transitive tournaments

Mariusz Woźniak

Denote by TT_n the transitive tournament on order n. In 1999 Sali and Simonyi proved that any self-complementary graph H on order n can be oriented in such a way, that the graph $H \oplus \sigma(H)$ is isomorphic to the graph TT_n (σ denotes the self-complementary permutation). A short proof of this fact was given by Gyárfás.

Since there are many results concerning the relationship between packing and self-complementary graphs, the above mentioned result suggests that one could get some non-trivial results by studying the packing problems in transitive tournaments.

Probably, the first result dealing with packing in transitive tournaments is the following theorem:

Theorem *Let TT_n be a transitive tournament on n vertices. Let $\overrightarrow{G}$ be a directed acyclic graph of order n such that $|E(\overrightarrow{G})| \leq \frac{3(n-1)}{4}$. Then $\overrightarrow{G}$ is 2-packable into TT_n* i.e. *there exist two arc-disjoint subgraphs of TT_n, both isomorphic to G.*

We discuss some other results and problems concerning the packing and the decomposition of graphs in transitive tournaments.

Some results on domination in graphs

Bohdan Zelinka

A mapping f of the vertex set V of a graph G into the set consisting of two numbers 1 and -1 with the property that the sum of f over the closed neighbourhood of any vertex of G is at least 1 is a signed dominating function on G. A family of signed dominating functions with the property that the sum of their values in any vertex x of G is at lost 1 is a signed domatic family on G. The maximum number of functions in such a family is the signed domatic number $\mathrm{ds}(G)$ of G. The signed domatic number is always an odd integer. For trees and wheels it is equal to 1.For a circuit it is 3, if the length of the circuit is divisible by 3, otherwise it is 1. Let G be the complete graph with n vertices.

$$\mathrm{ds}(G) = \begin{cases} n, & \text{for } n \text{ odd}, \\ p, & \text{for } n = 2p \text{ and } p \text{ odd}, \\ p-1, & \text{for } n = 2p \text{ and } p \text{ even}. \end{cases}$$

If a mapping f of V into the set consisting of 1 and -1 has the property that its sum over the closed neighbourhood of v is at least 1 for at least k vertices v of G, then f is a k-subdomination function on G. Its sum over V is its weight $w(f)$. The minimum of $w(f)$ over all k-subdominating functions f is the k-subdomination number of G. J. H. Hattingh conjectured that for k between $n/2$ and n this number is at most $2k-n$. This may be disproved by the graph of the three-dimensional cube and $k=5$.

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HYMNA TEORIE GRAFŮ

THE GRAPH THEORY HYMN

HYMNUS AUF DIE GRAPHENTHEORIE

HYMN TEORII GRAFÓW

A GRÁFELMÉLET HIMNUSZA

DIE GRAFIEKTEORIELIED

HIMNO DE LA GRAFOTEORIO

ГІМН ТЕОРІЇ ГРАФІВ

Text by Bohdan Zelinka
Music by Zdeněk Ryjáček

English text by Donald A. Preece
Deutscher Text von Anja Pruchnewski
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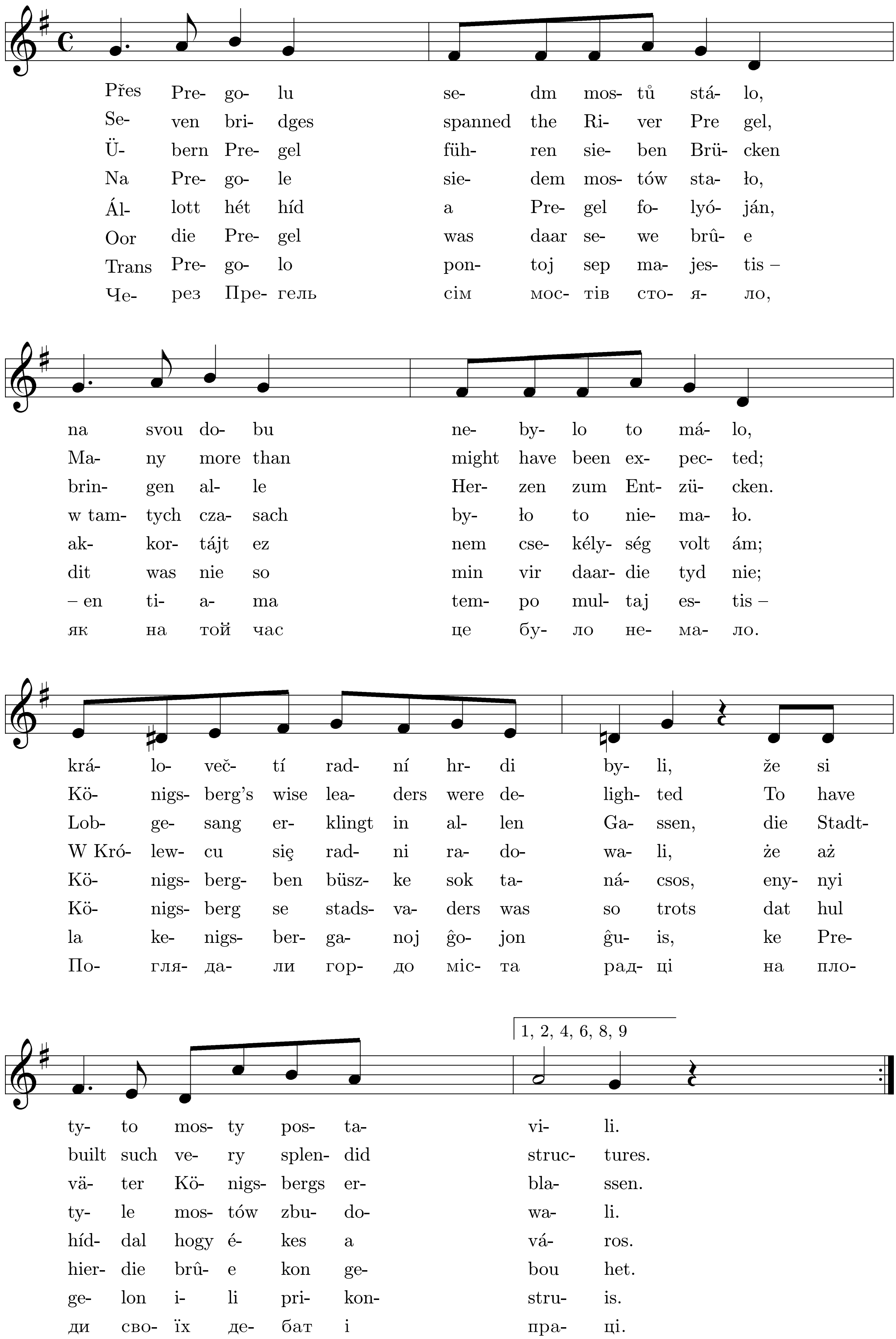
Přes Pre- go- lu se- dm mos- tů stá- lo,
Se- ven bri- dges spanned the Ri- ver Pre gel,
Ü- bern Pre- gel füh- ren sie- ben Brü- cken
Na Pre- go- le sie- dem mos- tów sta- ło,
Ál- lott hét híd a Pre- gel fo- lyó- ján,
Oor die Pre- gel was daar se- we brû- e
Trans Pre- go- lo pon- toj sep ma- jes- tis –
Че- рез Пре- гель сім мос- тів сто- я- ло,
na svou do- bu ne- by- lo to má- lo,
Ma- ny more than might have been ex- pec- ted;
brin- gen al- le Her- zen zum Ent- zü- cken.
w tam- tych cza- sach by- ło to nie- ma- ło.
ak- kor- tájt ez nem cse- kély- ség volt ám;
dit was nie so min vir daar- die tyd nie;
– en ti- a- ma tem- po mul- taj es- tis –
як на той час це бу- ло не- ма- ло.
krá- lo- več- tí rad- ní hr- di by- li, že si
Kö- nigs- berg's wise lea- ders were de- ligh- ted To have
Lob- ge- sang er- klingt in al- len Ga- ssen, die Stadt-
W Kró- lew- cu się rad- ni ra- do- wa- li, że aż
Kö- nigs- berg- ben büsz- ke sok ta- ná- csos, eny- nyi
Kö- nigs- berg se stads- va- ders was so trots dat hul
la ke- nigs- ber- ga- noj ĝo- jon ĝu- is, ke Pre-
По- гля- да- ли гор- до міс- та рад- ці на пло-
1, 2, 4, 6, 8, 9
ty- to mos- ty pos- ta- vi- li.
built such ve- ry splen- did struc- tures.
vä- ter Kö- nigs- bergs er- bla- ssen.
ty- le mos- tów zbu- do- wa- li.
híd- dal hogy é- kes a vá- ros.
hier- die brû- e kon ge- bou het.
ge- lon i- li pri- kon- stru- is.
ди сво- їх де- бат і пра- ці.


3, 5, 7
Refrén
Refrain
Eu- le- rův graf všech- ny stup- ně
Eu- le- rian graphs all have this re-
Eu- ler- scher Graph, Dir ist stets zu
Eu- le- ra graf, to fakt o- czy-
Eu- le- ri gráf: min- den fo- ka
Die stel- ling sê: Eu- ler- se gra-
En Eu- ler- -a gra- fo es- tas
Ей- ле- ра граф ма- є сут- ність
su- dé má — ta vě- ta vždyc- ky pla- tit
stric- tion: The de- gree of a- ny point is
ei- gen, daß sich die Kno- ten grad- gera- dig
wis- ty, wszy- stkie węz- ly są stop- ni pa-
pá- ros, és a té- tel mind- ö- rök- re
fie- ke het by al die pun- te e- we
pa- ra ĉi- u grad‘ – jen fak- to se- ne-
гар- ну, що всі точ- ки ма- ють сту- пінь
bu- de; nej- star- ší to ze všech
e- ven. That’s the ol- dest graph re-
zei- gen. Es hat die- ser ers- te
rzys- tych. Dos- ko- na- le zna- na
áll most; grá- fok- ról ez ál- lí-
gra- de. Dis die oud- ste re- sul-
ra- ra. Jen la plej mal- no- va
пар- ну. Це най- пер- ший ре- зуль-
vět o gra- fech, jež poz- nal svět.
sult That man- kind has e- ver known.
Satz im Buch der Gra- phen seinen Platz.
jest o gra- fach to pier- wsza z tez.
tás a vi- lág- nak ős- for- rás.
taat oor gra- fie- ke wat ons ken.
tez‘, sed va- li- das ĝi sen ĉes’.
тат, в кни- гу гра- фів цін- ний вклад.

1. Přes Pregolu sedm mostů stálo,
   na svou dobu nebylo to málo,
   královečtí radní hrdi byli,
   že si tyto mosty postavili.

2. V podvečeru k řece davy spějí,
   po mostech se sem tam procházejí,
   otázka jim jedna vrtá hlavou,
   jak by měli zvolit cestu pravou.

3. Přes most každý jednou chtějí jíti,
   pak se domů zase navrátiti;
   nějak jim to ale nevychází,
   jeden most vždy přebývá či schází.

Ref. Eulerův graf všechny stupně sudé
     má–ta věta vždycky platit bude;
     nejstarší to ze všech vět
     o grafech, jež poznal svět.

4. Vzpomněli si, muž že v městě žije,
   nad jiné jenž velmi učený je,
   měřictví i počtů mistr pravý;
   musí vzejít rada z jeho hlavy.

5. Mistr Euler smutně hlavou kroutí:
   "Jednou cestou nelze obsáhnouti
   mostů všech, jak panstvo sobě žádá.
   Nepomůže tady žádná rada.

Ref. Eulerův graf . . .

6. Zákony má přece svoje věda,
   proti nim se počíti nic nedá.
   Mosty ani vodní živel dravý
   do cesty se vědě nepostaví."

7. Když se vojna přes Pregolu hnala,
   její bouře mosty rozmetala.
   Eulerovo jméno u té řeky
   přežilo však mnohé lidské věky.

Ref. Eulerův graf . . .

8. Eulerovo jméno stále žije
   dokud žije grafů teorie.
   A čim více ubíhají léta,
   tím víc tato teorie vzkvétá.

9. Kolegové, naplňme své číše,
   k přípitku je zvedněm všichni výše,
   at se nám tu stále více vzmáhá
   teorie grafů naše drahá.

1. Seven bridges spanned the River Pregel,
   Many more than might have been expected;
   Königsberg's wise leaders were delighted
   To have built such very splendid structures.

2. Crowds each ev'ning surged towards the river,
   People walked bemused across the bridges,
   Pondering a simple-sounding challenge
   Which defeated them and left them puzzled.

3. Here's the problem; see if you can solve it!
   Try it out at home an scraps of paper!
   Starting out and ending at the same spot,
   You must cross each bridge just once each ev'ning.

Ref. Eulerian graphs all have this restriction:
     The degree of any point is even.
     That's the oldest graph result
     That mankind has ever known.

4. All the folk in Königsberg were frantic!
   All their efforts ended up in failure!
   Happily, a learn-ed math'matician
   Had his house right there within the city.

5. Euler's mind was equal to the problem:
   "Ah", he said, "You're bound to be disheartened.
   Crossing each bridge only once per outing
   Can't be done, I truly do assure you."

Ref. Eulerian graphs . . .

6. Laws of Nature never can be altered,
   We can'd change them, even if we wish to.
   Nor can flooded rivers or great bridges
   Interfere with scientific progress.

7. War brought strife and ruin to the Pregel;
   Bombs destroyed those seven splendid bridges.
   Euler's name and fame will, notwithstanding,
   Be recalled with Königsberg's for ever.

Ref. Eulerian graphs . . .

8. Thanks to Euler, Graph Theory is thriving.
   Year by year it flourishes and blossoms,
   Fertilising much of mathematics
   And so rich in all its applications.

9. Colleagues, let us fill up all our glasses!
   Colleagues, let us raise them now to toast the
   Greatness and the everlasting glory
   Of our Graph Theory, which we love dearly!

1. Übern Pregel führen sieben Brücken,
bringen alle Herzen zum Entzücken.
Lobgesang erklingt in allen Gassen,
die Stadtväter Königsbergs erblassen.

2. Jeden Abend ström' die Leut' zum Flusse,
enthusiastisch wimmeln sie voll Muße
hin und her und quer und 'rum im Kreise,
um zu lösen ein Problem ganz weise.

3. Und nun hört die Frage aller Fragen.
Sag, was würdest Du uns dazu sagen!
Gibt's 'nen Weg, der über jede Brücke
einmal führt genau und dann zurücke?

Ref. Eulerscher Graph, Dir ist stets zu eigen,
daß sich die Knoten grad-geradig zeigen.
Es hat dieser erste Satz
im Buch der Graphen seinen Platz.

4. Wer begann nach einem Weg zu suchen,
fand kein Ende, fing bald an zu fluchen.
Einer, der in diesem Städtchen wohnte,
brachte die Idee, die sich dann lohnte.

5. Meister Euler fiel sogleich der Groschen:
"Volk, zerrennt Euch doch nicht die Galoschen!
Solch ein Brückengang ist niemals machbar,
der Beweis hier zeige es Euch ganz klar."

Ref. Eulerscher Graph, ...

6. Der Natur Gesetze sind gegeben,
es umgeht sie keiner Macht Bestreben.
Weder Brücken noch des Wassers Fließen
könn' den Weg der Wissenschaft verdrießen.

7. Mit dem Kriege folgt dem Fluß Verderben,
alle Pracht der Brücken schlug in Scherben.
Eulers Ruf und Name wird auf Zeiten
die Geschichte Königsbergs begleiten.

Ref. Eulerscher Graph, ...

8. Dank Dir, Euler, blühend hat mit Wonnen
Graphenwissenschaft den Start genommen.
Vielfältigst nutzt man sie mit Fanatik,
sie bereichert unsre Mathematik.

9. Freunde, laßt uns heut' vom Weine leben,
Gläser füllen, klingen und erheben.
Graphentheorie, oh, schätzt sie alle,
dreimal hoch leb' sie, in jedem Falle!

1. Na Pregole siedem mostów stało,
w tamtych czasach było to niemało.
W Królewcu się radni radowali,
że aż tyle mostów zbudowali.

2. Jak co wieczór tłumy wyruszyły,
bo nad rzeką spacer bardzo miły.
Wciąż myśl jedna im zaprząta głowę,
jak tu wybra c tę właściwą drogę.

3. Przez most każdy raz przejść nie wracając,
znów się w domu znaleźć nie zbaczając.
Jakoś im to wcale nie wychodzi,
most zostaje lub brakuje w drodze.

Ref. Eulera graf, to fakt oczywisty,
wszystkie węzły są stopni parzystych.
Doskonale znana jest
o grafach to pierwsza z tez.

4. Aż nareszcie przypomnieli sobie
o człowieku żyjącym w ich grodzie,
Mistrzu geometrii i rachunków,
On podpowie w którym iść kierunku.

5. Ale Euler smutnie kręci głową,
bo odpowiedź na to ma gotową:
"Jedna ścieżka nie wystarczy, aby
pokryć mosty - nie ma na to rady."

Ref. Eulera graf ...

6. Nie pomogą tutaj dobre chęci,
nic w nauce nie da się pokręcić.
Mostów nowych nikt nie wybuduje,
wodny żywioł tym co są – daruje.

7. Kiedy wojna przez Pregołę gnała,
mosty wszystkie z ziemią wyrównała.
Jednak imię Mistrza nad tą rzeką
przeżyło już wiele długich wieków.

Ref. Eulera graf ...

8. Nowej wiedzy Euler dał podstawy,
przez co zyskał całe wieki sławy.
My śladami Mistrza podążamy
i naukę Jego rozwijamy.

9. Więc, Koledzy, na koniec powsta/nmy.
Wznosząc toast głośno tak śpiewajmy:
Niechaj żyje nam Teoria Grafów,
obwieszczajmy ją całemu światu.

1. Állott hét híd a Pregel folyóján,
akkortájt ez nem csekélység volt ám;
Königsbergben büszke sok tanácsos,
ennyi híddal hogy ékes a város.

2. Alkonyatkor kavarog a népség,
és fejükben hánytorog a kétség:
hogy' lehetne jó utat találni,
minden hídon egyszer általjárni.

3. Mind a hét híd egyszer essen útba,
séta végén otthon lenni újra;
de a jó út valahol hibázik,
egy híd mindig fölös vagy hiányzik.

Ref. Euleri gráf: minden foka páros,
és a tétel mindörökre áll most;
gráfokról ez állítás
a világnak ősforrás.

4. Él egy ember, gondoljunk csak rája,
itt minálunk, nincs tudásban párja;
úgy érti a számolást és mérést,
hogy elébe kell tárni a kérdést.

5. Euler mester fejét búsan rázza:
"Oly talány ez, nincsen megoldása;
nincs oly út, mint uraságtok kérik,
amely minden hidat egyszer érint.

Ref. Euleri gráf: . . .

6. Érckemény a tudományos tétel,
mit sem kezdhet ellene a kétely;
árad a víz, szilárd a híd rajta,
még erősb a tudomány hatalma."

7. Háború jött a Pregel folyóra,
minden hídját ízzé-porrá szórta;
nemzedékek hosszú során fénylik
Euler és a folyó neve végig.

Ref. Euleri gráf: . . .

8. Euler híre nem ér addig véget,
míg csak élni fog a gráfelmélet;
s egyik évre amint jön a másik,
az elmélet mind jobban virágzik.

9. Jó kollégák, töltsük meg a kelyhet,
áldomásra mind emeljük feljebb:
nekünk a gráfelmélet oly drága,
hadd teremjen sok-sok szép virága!

1. Oor die Pregel was daar sewe brûe
dit was nie so min vir daardie tyd nie;
Königsberg se stadsvaders was so trots
dat hul hierdie brûe kon gebou het.

2. Teen die aand dan wandel al die mense
oor die brûe het hul loop en wonder,
oor 'n vraag wat steeds by hul bly spook het
oor die roete waar hul langs geloop het.

3. Elke brug moet net een maal gebruik word
en die roete moet dan weer tuis eindig;
maar dit wou maar net nooit reg uitwerk nie
want die brûe was nie reg geplaas nie.

Ref. Die stelling sê: Eulerse grafieke
het by al die punte ewe grade.
Dis die oudste resultaat
oor grafieke wat ons ken.

4. Hul onthou toe van 'n man wat daar woon
met geleerdheid, meer as ander mense –
Meester van die meetkunde en nog meer –
hy moes oor die groot probleem nou raad gee.

5. Meester Euler moes hul toe dit meedeel:
"Dis onmoontlik in 'n enkel roete
al die brûe een maal oor te wandel;
daar's geen raad wat hiervoor sal kan help nie."

Ref. Die stelling sê: . . .

6. Die natuur het mos sy eie wette
dis nie moontlik om hul teen te gaan nie,
nóg die brûe nóg die wilde waters
kan die wetenskap se gang versteur nie.

7. Toe die oorlog oorspoel daar na Pregel
is die brûe in die slag vernietig
maar die naam van Euler sal bly voortleef
vir nog baie jare by die Pregel.

Ref. Die stelling sê: . . .

8. Met die stelling word sy naam verewig
soos Grafiekte͡orie sal dit bly lewe
jaar na jaar kom nuwe resultate
wat die groei en bloei daarvan bevestig.

9. Vriende kom ons vul nou al ons glase
vriende kom ons drink nou hierdie heildronk
en ons hoop vir groei en sterkte voortaan
vir Grafiekte͡orie wat ons so lief het!

1. Trans Pregolo pontoj sep majestis –
   – en tiama tempo multaj estis –
   la kenigsberganoj ĝojon ĝuis,
   ke Pregelon ili prikonstruis.

2. Ĉiutage antaŭ la vespero
   la urbanoj venas al rivero.
   Ĉiam ilin ĝenas la problemo,
   kia estu la promen-sistemo.

3. Ili volas pontojn sep transiri,
   poste hejmen siajn paŝojn stiri
   ofte ili fari tion provas,
   sed neniam ili solvon trovas.

Ref. En Euler-a grafo estas para
   ĉiu grad' – jen fakto senerara.
   Jen la plej malnova tez',
   sed validas ĝi sen ĉes'.

4. Ili scias, ke en certa domo
   vivas iu scioplena homo;
   vera majstro de matematiko:
   helpos de la sciencist' logiko.

5. Majstro Euler sian kapon skuas:
   "La matematiko nin instruas:
   tia voj' sep pontojn ne entenas.
   Jen – rezulton do ni ne divenas.

Ref. En Euler-a ...

6. Siajn leĝojn havas la scienco,
   nei ilin estas ja sen senco.
   Pontoj eĉ inundoj de l'rivero
   ne haltigos marŝon de la vero."

7. La milito Kenigsbergon skuis,
   ĝiaj ŝtormoj pontojn sep detruis.
   Sed la nomo Euler ĉe l' rivero
   vivas dum longega homa ero.

Ref. En Euler-a ...

8. Ĉiam vivu tiu ci genio,
   dum ekzistos grafoteorio.
   Kvankam tre rapide tempo fluas,
   tiu teorio evoluas.

9. Gekolegoj, glasojn ni plenigu,
   por la tosto ĉiujn ni instigu;
   vivu en estonta historio
   nia kara grafoteorio.

1. Через Прегель сім мостів стояло,
   як на той час це було немало.
   Поглядали гордо міста радці
   на плоди своїх дебат і праці.

2. Кожен вечір юрби йшли до річки,
   по мостах бродити завжди слічно,
   та не мали спокою од того,
   бо шукали правильну дорогу:

3. всі мости ті по разу одному
   перейти й вернутися додому.
   Та задачка ця не піддається:
   то той двічі, то якийсь минеться.

Пр. Ейлера граф має сутність гарну,
   що всі точки мають ступінь парну.
   Це – найперший результат,
   в книгу графів цінний вклад.

4. Та згадали, що між ними чемно
   проживає славний муж учений,
   він рахує й міряє все радо,
   дасть він точно цій проблемі раду.

5. Але Ейлер крутить головою:
   "Не пройти все ходкою одною,
   як ви це собі запланували,
   хоч би ви роками там блукали."

Пр. Ейлера граф ...

6. Теорему цю вже не змінити,
   це – законів непохитний злиток.
   Ні потопи, ні великі мóсти
   не зупинять науковий поступ.

7. Як війна зла через Прегель гнала,
   то мости з землею порівняла.
   Им'я ж Ейлера понад рікою
   не поховане віків юрбою.

Пр. Ейлера граф ...

8. Нову галузь, Ейлер, розпочав ти,
   що їй суджено цвісти й зростати.
   Користують із науки графів
   математики усіх парафій.

9. То ж, колеги, підіймаймо чаші,
   вип'єм дружно за здобутки наши:
   графтеоріє, рясній тривало,
   любимо тебе й п'ємо во славу!

Programme of the Conference

Sunday		
14:00 - 22:00	Registration	
18:00 - 22:00	Dinner	

Monday		
07:30 - 08:30	Breakfast	
08:40 - 08:45	Opening	
08:45 - 09:35	*Pavol HELL*	Proper interval graphs and bigraphs
09:40 - 10:00	*Martin BAČA*	Edge-antimagic total labelings of graphs
10:05 - 10:25	*Joe RYAN*	Exclusive sum labeling
10:30 - 11:00	Coffee break	
11:00 - 11:20	*Roman NEDELA*	Enumeration of unrooted maps with given genus
11:25 - 11:45	*Andrea SEMANIČOVÁ*	Numbers of edges in supermagic graphs
11:50 - 12:10	*Ľubica LÍŠKOVÁ*	Exponents of one-vertex maps and t-balanced maps
12:15 - 12:35	*Michael KUBESA*	Factorizations of complete graphs into caterpillars of diameter 5 with at least one vertex of degree 2
12:40 - 13:20	Lunch	
15:00 - 15:50	*Mirka MILLER*	Moore bound and beyond: A survey of the degree/diameter problem
15:55 - 16:15	*Pavel HÍC*	Randomly $2C_n$ graphs
16:20 - 16:50	Coffee break	
16:50 - 17:10	*Mariusz WOŹNIAK*	On some packing and decomposition problems in transitive tournaments
17:15 - 17:35	*Zuzana KOCKOVÁ*	Decomposition of plane graphs into closed trails
17:40 - 18:00	*Sergej ŠEVEC*	On some new types and kinds of polyhedra non-inscribability
18:00 - 18:30	Dinner	
20:00 -	Welcome party	

Tuesday		
07:30 - 08:30	Breakfast	
08:45 - 09:35	*Geňa HAHN*	Cops, robbers and graphs
09:40 - 10:00	*Mirko HORŇÁK*	t.b.a.
10:05 - 10:25	*Jiří FIALA*	Subchromatic index - properties and complexity
10:30 - 11:00	Coffee break	
11:00 - 11:20	*Robert JAJCAY*	Vertex-transitive graphs: A survey of methods and problems
11:25 - 11:45	*Tomáš KAISER*	A revival of the Girth Conjecture
11:50 - 12:10	*Edita MÁČAJOVÁ*	Fano colourings of cubic graphs and the Fulkerson Conjecture
12:15 - 12:35	*Stanislav JENDROĽ*	On list chromatic number of cartesian product of two graphs
12:40 - 13:20	Lunch	
14:00 - 14:50	*Zdeněk RYJÁČEK*	Stability of graph properties
14:55 - 15:15	*Daniël PAULUSMA*	Tracing locally constrained homomorphisms
15:20 - 15:50	Coffee break	
15:50 - 16:10	*Marián KLEŠČ*	Small crossing numbers of derived line graphs
16:15 - 16:35	*Emília DRAŽENSKÁ*	The crossing number of products of 6-vertex trees with cycles
17:30 - 19:00	Walking	
19:00 -	Dinner at a fireplace	

Wednesday		
07:30 - 08:30	Breakfast	
08:45 - 09:35	*Alexander ROSA*	Extended Petersen graphs
09:40 - 10:00	*Martin KLAZAR*	Counting noncrossing graphs
10:05 - 10:25	Coffee break	
10:25 - 11:45	*Bohdan ZELINKA*	Some results on domination in graphs
10:50 - 11:10	*Martin KNOR*	Distance independent domination in iterated line graphs
11:30 - 18:00	Trip	
18:00 - 18:30	Dinner	

Thursday		
07:30 - 08:30	Breakfast	
08:45 - 09:35	*Ladislav STACHO*	Graph traversal
09:40 - 10:00	*Tomáš MADARAS*	Two variations on Franklin's theorem
10:05 - 10:25	*Igor FABRICI*	Unavoidable configurations in outerplanar graphs
10:30 - 11:00	Coffee break	
11:00 - 11:20	*Zdzisław SKUPIEŃ*	t.b.a.
11:25 - 11:45	*Rostislav CAHA*	On antipodes in hypercubes
11:50 - 12:10	*Pavel HRNČIAR*	Minimal eccentric sequences with two values
12:15 - 12:35	*Gabriel SEMANIŠIN*	Non-intersecting longest paths in strongly connected oriented graphs
12:40 - 13:20	Lunch	
15:00 - 15:50	*Jozef ŠIRÁŇ*	Vertex-transitive maps
15:55 - 16:15	*Jana ŠIAGIOVÁ*	One-vertex quotient genus of covalence sequences of Cayley maps
16:20 - 16:50	Coffee break	
16:50 - 17:10	*Mária IPOLYIOVÁ*	An upper bound on the size of the smallest trivalent regular maps of prime face length and of large planar width
17:15 - 17:35	*Ľubomír TÖRÖK*	Layout volumes of hypercubes
17:40 - 18:00	*Marcel ABAS*	Cayley maps on surfaces with boundary
19:00 -	Farewell party	

Friday		
07:30 - 08:30	Breakfast	
08:45 - 09:35	*Dalibor FRONČEK*	Incomplete and non-compact round robin tournaments
09:40 - 10:00	*Daniel KRÁĽ*	Closure for the property of having a hamiltonian prism
10:05 - 10:25	*Roman SOTÁK*	Maps of p-gons with a ring of q-gons
10:30 - 11:00	Coffee break	
11:00 - 11:20	*Peter MIHÓK*	Additive and hereditary properties of systems of objects
11:25 - 11:45	*Milan TUHÁRSKY*	On vertices with at most one neighbour of large degree in planar graphs
11:50 - 12:10	*František KARDOŠ*	Octahedral fulleroids
12:10 - 12:30	Lunch	

Plan of Vyšné Ružbachy