12^{th} Annual Conference

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PROGRAM and ABSTRACTS

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Sam Houston State University

Huntsville, TX

Organized by

Daniela Ferrero

Luis David Garcia-Puente

Martin Malandro

Ken Smith

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Department of Mathematics and Statistics

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PROGRAM

Saturday	08.20 – 08.30	Opening of the Conference
	08.30 – 09.20	Invited Speaker: Chris Godsil
	09.30 – 10.20	Invited Speaker: Federico Ardila
	10.30 – 11.00	Coffee Break
	11.00 – 11.20	Contributed Talks
	11.30 – 11.50	Contributed Talks
	12.00 – 12.20	Contributed Talks
	12.30 – 14.00	Lunch Break
	14.00 – 14.50	Invited Speaker: Catherine Yan
	15.00 – 15.50	Invited Speaker Gregg Musiker
	16.00 – 16.30	Coffee Break
	16.30 – 16.50	Contributed Talks
	17.00 – 17.20	Contributed Talks
	17.30 – 17.50	Contributed Talks
Sunday	08.30 – 09.20	Invited Speaker: Michael Orrison
	09.30 – 10.20	Invited Speaker: Rosa Orellana
	10.30 – 11.00	Coffee Break
	11.00 – 11.20	Contributed Talks
	11.30 – 11.50	Contributed Talks
	12.00 – 12.50	Invited Speaker: Bernhard Schmidt

08.00–08.20 **Registration**

08.20–08.30 **Opening of the Conference** (CHSS 140)

08.30–09.20 **Invited Lecture** (CHSS 140) *Chair: Daniela Ferrero*

- **Graph Spectra and Quantum State Transfer** *Chris Godsil*

09.30–10.20 **Invited Lecture** (CHSS 140) *Chair: Daniela Ferrero*

- **Combinatorics of** $\mathrm{CAT}(0)$ **Cube Complexes** *Federico Ardila*

10.30–11.00 **Coffee Break**

11.00–12.20 **Contributed Talks Session I** (CHSS 206) *Chair: Douglas Klein*

- **Solvable Permutation Groups and Orbits on Power Sets** *Yong Yang*
- **Counting in Coxeter groups** *Matthew Samuel*
- **Twin Towers of Hanoi** *Zoran Sunic*

11.00–12.20 **Contributed Talks Session II** (CHSS 226) *Chair: Alison Marr*

- **Self Similar Graphs** *Kiran Chilakamarri*
- **Functigraphs: An Extension of Permutation Graphs** *Eunjeong Yi*
- **Domination in Functigraphs** *Cong Kang*

11.00–12.20 **Contributed Talks Session III** (CHSS 232) *Chair: Dan Tamir*

- **On the Structure of the H-vector of Paving Matroids** *Criel Merino*
- **A Survey of Oriented Hypergraphs** *Lucas Rusnak*
- **The** G**-Shi Arrangement, and its Relation to** G**-parking Functions** *Art Duval*

12.30–14.00 **Lunch Break**

14.00–14.50 **Invited Lecture** (CHSS 140) *Chair: Luis Garcia-Puente*

- **The Symmetry between Crossings and Nestings in Combinatorial Structures** *Catherine Yan*

15.00–15.50 **Invited Lecture** (CHSS 140) *Chair: Luis Garcia-Puente*

- **Linear Systems on Tropical Curves** *Gregg Musiker*

16.00–16.30 **Coffee Break**

16.30–17.50 **Contributed Talks Session IV** (CHSS 206) *Chair: Lucas Rusnak*

- **On the relative distances of points on the boundary of a plane convex body** *Zhanjun Su*
- **Cones and Ternary Codes** *Gretchen Matthews*
- **On the Poles of the Ihara Zeta Function of Cones over Regular Graphs** *Marius Somodi*

16.30–17.50 **Contributed Talks Session V** (CHSS 226) *Chair: Eunjeong Yi*

- **Intrinsic Metrics on Graphs** *Douglas Klein*
- **Dinormal Graphs** *Vladimir Rosenfeld*
- **The Lattice of Multistationary Chemical Reaction Networks** *Anne Shiu*

16.30–17.50 **Contributed Talks Session VI** (CHSS 232) *Chair: Zoran Sunic*

- **Finiteness on Toric Markov Chain Models** *Abraham Martin del Campo*
- **A Combinatorial Commutative Algebra Proof of the Littlewood-Richardson Rule** *Nickolas Hein*
- **A Generalization of Binomial Orthogonality Identities** *Mohsen Maesumi*

08.30–09.20 **Invited Lecture** (CHSS 140) *Chair: Martin Malandro*

- **Algebraic Voting Theory** *Michael Orrison*

09.30–10.20 **Invited Lecture** (CHSS 140) *Chair: Martin Malandro*

- **Kronecker Coefficients** *Rosa Orellana*

10.30–11.00 **Coffee Break**

11.00–11.50 **Contributed Talks Session VII** (CHSS 206) *Chair: Cong Kang*

- **Using Implicit Posets to Simplify Order Preference Solicitation** *Andrew Chen*
- **Japanese Candlestick Patterns in Stock Market Forecasting: Fact or Fiction?** *Adrian Heinz and Marty Thomas*

11.00–11.50 **Contributed Talks Session VIII** (CHSS 226) *Chair: Criel Merino*

- **Vox-solid's Thickening and its Hamiltonicity** *Luz Gasca-Soto*
- **Using Star Convex Polygons for Shape Representation** *Dan Tamir*

11.00–11.50 **Contributed Talks Session IX** (CHSS 232) *Chair: Art Duval*

- **Counting Subtrees: Enumerative and Extremal Questions** *Hua Wang*
- **In Search of a Strongly Directed Regular Graph** *Jose Gamez*

12.00–12.50 **Invited Lecture** (CHSS 140) *Chair: Ken Smith*

- **Circulant Weighing Matrices of Small and Large Weight** *Bernhard Schmidt*

Invited Lectures

Graph Spectra and Quantum State Transfer

Chris Godsil

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If A is the adjacency matrix of X we define a transition matrix

$$H(t) := \exp(itA);$$

this is a unitary matrix which defines a so-called continuous quantum walk. I will discuss how questions of physical interest concerning H can be attacked using tools developed in work on eigenvalues of graphs. This has led to new results on quantum state transfer, and to a number of interesting problems in graph theory.

Combinatorics of $\mathrm{CAT}(0)$ Cube Complexes

Federico Ardila

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A "cube complex" X is a space built by gluing cubes together. We say that X is "$\mathrm{CAT}(0)$" if it has non-positive curvature - roughly speaking, this means that X is shaped like a saddle. $\mathrm{CAT}(0)$ cube complexes play an important role in pure mathematics (group theory) and in applications (phylogenetics, robot motion planning). We show that, surprisingly, $\mathrm{CAT}(0)$ cube complexes can be described completely combinatorially. This description gives a proof of the conjecture that any d-dimensional $\mathrm{CAT}(0)$ cube complex X "fits" in d-dimensional space. It also leads to an algorithm for finding the shortest path between two points in X (and hence to find the fastest way to move a robot from one position to another one). The talk will describe joint work with Megan Owen and Seth Sullivant.

Contributed Talks Session I (CHSS 206)

Solvable Permutation Groups and Orbits on Power Sets

Yong Yang

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A permutation group G acting on a set Ω induces a permutation group on the power set $\mathscr{P}(\Omega)$. Let G be a finite permutation group of degree n and let $s(G)$ denote the number of set-orbits of G. We determine $\inf(\frac{\log_2 s(G)}{n})$ over all solvable groups G. This answers a question of Babai and Pyber 'Permutation groups without exponentially many orbits on the power set', J. of Comb. Theory, Series A, 66 (1994), 160-168.

Counting in Coxeter groups

Matthew Samuel

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A Coxeter group is a type of group with a distinguished set of generators of order 2. An expression for an element in terms of the generators that is of minimal length is called a reduced word. We have found some formulas counting reduced words for elements of Coxeter groups. Our formulas are in terms of partially ordered sets that can naturally be associated to each element that turn out to determine many important properties of the group. Indeed, knowing all of the partially ordered sets is equivalent to knowing the isomorphism class of the entire group. We will discuss the partially ordered sets as well as some of their implications.

Twin Towers of Hanoi

Zoran Sunic

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We model the well known Towers of Hanoi Problem by a self-similar group of rooted tree automorphisms. This enables us to solve a version of the problem involving simultaneous and intertwined work with two sets of pegs and disks.

Contributed Talks Session II (CHSS 226)

Self Similar Graphs

Kiran Chilakamarri

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Let G be a graph on n vertices, $1, 2, \ldots, n$. Let J be a symmetric subgraph of $K(n, n)$, the complete bipartite graph on $1, 2, \ldots, n$ and $1', 2', \ldots, n'$. By symmertic subgraph of $K(n, n)$ I mean (i, j') is an edge of J if and only if (j, i') is also an edge of J. We construct a sequence of graphs $G(0), G(1), \ldots$ as follows: $G(0) = G$. The graph $G(n)$ is obtained from $G(n-1)$ by replacing each vertex by a copy of G and by replacing each edge of $G(n-1)$ by a copy of J. I am interested in Limit of the chromatic numbers as n goes to infinity for any given pair (G, J). We will discuss some recent results.

Functigraphs: An Extension of Permutation Graphs

Eunjeong Yi

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Let G_1 and G_2 be disjoint copies of a graph G, and let $f : V(G_1) \to V(G_2)$ be a function. Then, a *functigraph* $C(G, f) = (V, E)$ has the vertex set $V = V(G_1) \cup V(G_2)$ and the edge set $E = E(G_1) \cup E(G_2) \cup \{uv : v = f(u)\}$. A functigraph is a generalization of a *permutation graph* (or a *generalized prism*) in the sense of Chartrand and Harary. We discuss colorability and planarity of functigraphs. This is a joint work with A. Chen, D. Ferrero, and R. Gera.

Domination in Functigraphs

Cong Kang

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Let G_1 and G_2 be disjoint copies of a graph G, and let $f : V(G_1) \to V(G_2)$ be a function. Then a *functigraph* $C(G, f) = (V, E)$ has the vertex set $V = V(G_1) \cup V(G_2)$ and the edge set $E = E(G_1) \cup E(G_2) \cup \{uv \mid u \in V(G_1), v \in V(G_2), v = f(u)\}$. A functigraph is a generalization of a *permutation graph* (also known as a *generalized prism*) in the sense of Chartrand and Harary. In this paper, we study domination in functigraphs. It is readily seen that $\gamma(G) \leq \gamma(C(G, f)) \leq 2\gamma(G)$. We investigate for graphs generally, and for cycles in great detail, the functions which achieve the upper and lower bounds, as well as the realization of the intermediate values. This is a joint work with L. Eroh, R. Gera, C. Larson, and E. Yi.

Contributed Talks Session III (CHSS 232)

On the Structure of the H-vector of Paving Matroids

Criel Merino

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Paving matroids have received a lot of attention lately. Our main result states that the H-vector of paving matroids satisfies an old conjecture by Richard Stanley.

A Survey of Oriented Hypergraphs

Lucas Rusnak

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The set of simple cycles of a graph constitute a complete classification of the circuits of the graphic matroid — the minimally dependent columns in the associated incidence matrix. An oriented hypergraph is an oriented incidence structure that provides a natural combinatorial model of integral matrices. We will define the necessary hypergraphic structures essential to extending the combinatorial classification of graphic circuits to any $\{0, +1, -1\}$-matrix, and examine the current state and recent progress towards a complete classification of the circuits of rational matrices.

The G-Shi Arrangement, and its Relation to G-parking Functions

Art Duval

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Pak and Stanley found a bijection between parking functions on $[n]$ and regions of the complement of the Shi arrangement, $\{x_i - x_j = 0, 1\colon 1 \leq i < j \leq n\}$. In particular, there is a somewhat natural labeling of the regions such that every region has a different label, and these labels are precisely the parking functions on $[n]$.

We now define a G-Shi hyperplane arrangement

$$\{x_i - x_j = 0, 1\colon 1 \leq i < j \leq n;\ \{i, j\} \text{ is an edge of } G\}$$

of an arbitrary graph G, and compare the regions of the complement of this arrangement to G-parking functions, a well-studied generalization of parking functions to arbitrary graphs. In particular, while the Pak-Stanley labels of regions are no longer necessarily unique, we conjecture that the set of different Pak-Stanley labels of regions of the G-Shi arrangement is precisely the set of $(G + v)$-parking functions, where $G + v$ is the join of G with a single vertex v. We offer some evidence in favor of the conjecture, including a proof that every label is a parking function.

Invited Lectures

The Symmetry between Crossings and Nestings in Combinatorial Structures

Catherine Yan

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This talk is a survey of recent progresses on the enumeration of crossings and nestings in combinatorial structures. We describe a new combinatorial model– the fillings of moon polyominoes, which provides a unified approach to classical combinatorial analysis on permutations, words, matchings, set partitions, multigraphs, and Young tableaux. In the talk we will concentrate on three pairs of combinatorial statistics over the fillings

(1) the longest northeast (NE) and southeast (SE) chains,
(2) the number of NE and SE chains of length 2, and
(3) four families of mixed statistics (to be defined in the talk).

We present enumerative results and show that there is an elegant symmetry between each pair of statistics. These results are connected to many other areas, for example, free probability theory, random matrix theory, representation theory, and mathematical biology.

Linear Systems on Tropical Curves

Gregg Musiker

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A tropical curve is a metric graph with possibly unbounded edges, and tropical rational functions are continuous piecewise linear functions with integer slopes. We define the complete linear system of a divisor on a tropical curve analogously to the classical counterpart. We investigate the structure of such linear systems as a cell complex and show that they are quotients of tropical modules, finitely generated by vertices of the cell complex. Using a finite set of generators, these linear systems define maps from tropical curves to tropical projective space. This is joint work with Christian Haase and Josephine Yu.

Contributed Talks Session IV (CHSS 206)

On the relative distances of points on the boundary of a plane convex body

Zhanjun Su

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Let C be a convex body. The relative distance of points a, b in C is the ratio of the Euclidean distance of a and b to the half of the Euclidean distance of a^1, a^2 in C such that a^1a^2 is a longest chord of C parallel to the segment ab. We consider nine or ten points on the boundary of a plane convex body, and disprove a conjecture with respect to their corresponding problems.

Cones and Ternary Codes

Gretchen Matthews

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Low-density parity-check codes have attracted much attention due to their near capacity performance when paired with iterative decoding algorithms. Much analysis has been done in the binary case. However, many applications benefit from the use of a larger alphabet. In this talk, we consider ternary parity-check codes and graph cover decoding.

On the Poles of the Ihara Zeta Function of Cones over Regular Graphs

Marius Somodi

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The Ihara zeta function of a finite undirected graph is a function of complex argument associated to the graph, which is defined as an infinite Euler product. We present a simple formula that relates the Ihara zeta function of a cone over a regular graph to the spectrum of the adjacency matrix of the graph. Using this formula, we describe the possible location of the poles of the Ihara zeta function of a cone over a regular graph.

Contributed Talks Session V (CHSS 226)

Intrinsic Metrics on Graphs

Douglas Klein

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Graphs are a cosmopolitan representation of a wide range of things: “group” networks in sociology, food-webs in ecology, reaction networks in biochemistry, Feynman diagrams in physics, electrical circuits in engineering & physics, and molecules in chemistry, & molecular biology. As molecular representations, graphs seemingly retain information about only a small part of a molecule’s character; in particular, they seem to suppress geometric information (though ever since the introduction of molecular graphs $\sim$150 years ago, they have been extensively utilized). Thus the intrinsic characteristics of graphs are of general interest. Naturally there is a question of intrinsic metrics on graphs, independently of whether the graphs are used to represent molecules, or whatever.

In mathematical graph-theory, there is extensive work on the shortest-path metric, and very little on any other possible metric. Still one might imagine other possibilities for an intrinsic graph metric, such as we address here, along with some ideas for uses of any such further metrics.

The Lattice of Multistationary Chemical Reaction Networks

Anne Shiu

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In a chemical reaction network, the concentrations of chemical species evolve in time, governed by the polynomial differential equations of mass-action kinetics. The question of whether a reaction network admits multiple steady states is equivalent to asking whether a parametrized system of polynomials has multiple positive solutions. This talk focuses on the lattice (by way of inclusion) of small reaction networks that admit multiple steady states, and in particular on the minimal such networks. This is joint work with Badal Joshi.

Multivariate descent polynomials over Stirling permutations

Mirkó Visontai

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A Stirling permutation is a permutation of the multiset $\{1, 1, 2, 2, \ldots, n, n\}$ such that for all j in $[n]$, all entries between the two occurrences of j exceed j. A descent in a Stirling permutation $q = q_1 \cdots q_{2n}$ is the index i in $[2n]$ for which $q_i > q_{i+1}$ or $i = 2n$. The number of Stirling permutations with exactly k descents is counted by the so-called second-order Eulerian numbers $\langle\langle n, k \rangle\rangle$. We give a multivariate refinement of their generating function and prove a generalization of a result of Bóna that the generating polynomial of these numbers has only real roots.

Contributed Talks Session VI (CHSS 232)

Finiteness on Toric Markov Chain Models

Abraham Martin del Campo

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By Hilbert's Basis Theorem, ideals of polynomial rings in a finite number of indeterminates are finitely generated. Of course, this is no longer true for ideals in polynomial rings with an infinite number of indeterminates; but there, some ideals with enough structure can be described in a finite manner. This phenomena, of which I will try to give several examples, appears in algebraic statistics. We will focus on the case when the ideals we consider are toric ideals that encode Markov chain models. For these models, we associate a multi-digraph, the "state-graph," which gives a combinatorial description of our model, and we use it to analyze the infinite behavior of the model.

A Combinatorial Commutative Algebra Proof of the Littlewood-Richardson Rule

Nickolas Hein

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The Littlewood-Richardson rule is a combinatorial fact which has connections to geometry and representation theory. The classical rule in geometry gives means to compute structure coefficients for multiplication in the cohomology of the Grassmannian. Eisenbud and Harris reformulated a specialization (the Pieri rule) by giving a deformation of schemes whose limit (as a scheme) has the correct structure coefficients. They later gave a partial generalization to a full Littlewood-Richardson rule. I use a Gröbner degeneration to study the intersection given by Eisenbud-Harris, and I give the scheme structure of some intersections explicitly. This will add to the massive combinatorial information that we have pertaining to the Grassmannian and may give a way to generalize their work further.

A Generalization of Binomial Orthogonality Identities

Mohsen Maesumi

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The orthogonality identities describe the alternate dot product of a row of Pascal's Triangle with the equally spaced elements on certain lines parallel to a side of the Triangle. We generalize these identities in several directions: (a) expanded choice of lines and elements on them, (b) use of combination with limited repetition, and (c) expression in higher dimensions. The identities can be derived by counting the number of solutions of certain linear systems of equations and inequalities by using two counting techniques: the principle of inclusion and exclusion, and a partition approach. The resulting identities are related to "the generalized factorial coefficients". Connections to Latin squares and counting problems of matrices with prescribed row and column sums are described.

Invited Lectures

Algebraic Voting Theory

Michael Orrison

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In this talk, I'll give an introduction to what might be called "algebraic voting theory." In particular, I'll show how the representation theory of the symmetric group can play a natural and sometimes surprising role when it comes to formulating and answering questions in voting theory. I'll also describe an algebraically motivated extension of the Condorcet criterion that leads to some unexpected results concerning forbidden words of generalized Condorcet winners.

Kronecker Coefficients

Rosa Orellana

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One of the main open problems in combinatorial representation theory of the symmetric group is to obtain a combinatorial interpretation for the Kronecker coefficients. The Kronecker coefficients are obtained when when we take the tensor product of two irreducible representations of the symmetric group.

This talk is a survey what is known about the Kronecker coefficients and describe some recent results. We will present a closely related family of coefficients called the reduced Kronecker coefficients and their importance in understanding the Kronecker coefficients. In particular, we will discuss the complexity and stability of the Kronecker coefficients. This is joint work with Emmanuel Briand and Mercedes Rosas.

Contributed Talks Session VII (CHSS 206)

Using Implicit Posets to Simplify Order Preference Solicitation

Andrew Chen

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Consider the request "Please list all movies you have ever seen by order of most favorite to least favorite." While there may be many reasons why obtaining the answer to this question could be desirable, the asking of the question itself has severe complications.

Consider instead the question "Which of these two movies do you like better?" Questions like this contribute to the amount of ordering information in a partially ordered set (poset). If questions like this are asked over enough possible options, a total ordering will result, and it provides a way of breaking down the process of obtaining the information in a way that has less usability issues than a one-time solicitation of a complete total ordering.

If the questions asked are comparisons between random elements, and are asked over time, this also provides a way of dealing with changing preferences over time by discarding the oldest piece of contradictory preference information provided. The problem of identifying such a piece is highly related to other some other problems such as dynamic cycle detection. Note that this can be generalized to many similar efforts at determining a possibly changing order but with limited information gathering abilities.

Japanese Candlestick Patterns in Stock Market Forecasting: Fact or Fiction?

Adrian Heinz[1] *and Marty Thomas*[2]

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Japanese Candlestick Patterns is a popular method used to forecast future stock market direction. Although Japanese Candlesticks were originally conceived in Japan, they were brought to the West in the early nineties and since then, they have become a popular Technical Analysis tool primarily used as indicators of trend reversals. In this talk, we study the effectiveness of Japanese Candlesticks by performing statistical studies on historical data of stock market indexes.

Contributed Talks Session VIII (CHSS 226)

Vox-solid's Thickening and its Hamiltonicity

Luz Gasca-Soto

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A voxel is a unitary cube in the 3-space as a pixel is a unitary square in the plane. A Vox-solid V is a finite union of voxels such that:

(1) The intersection voxels is only by faces, edges or vertices;
(2) The boundary of V is a non-singular surface.

In our representation we associate with each vox-solid a graph whose vertices correspond with the faces on its boundary, and whose edges indicate the adjacency relationship between faces. For a given vox-solid such a graph is called the face adjacency graph of the vox-solid. It is always a 4-regular, 4-connected graph embedded in an orientable surface.

The problem of representing efficiently a vox-solid has been transformed into one of determining a Hamiltonian cycle in its face and this problem is well known to be an NP-complete problem. The thickening of a vox-solid V is a refinement of V and it consists on splitting each voxel, of the original vox-solid, in eight sub-voxels. We prove that the thickening of any vox-solid is a Hamiltonian graph and admits a Hamiltonian decomposition.

Using Star Convex Polygons for Shape Representation

Dan Tamir

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One of the active areas of research in image processing includes shape-representation where pixels in the boundary of image-objects are represented using a set of descriptors. Some of the commonly used descriptors include chain codes, Fourier descriptors, B-Splines, and object signature. A fixed angle object signature is the set of distances measured from the object center to its boundary in increments of equal angles. A problem with the fixed angle method occurs with certain concave objects where the same angle might yield more than one distance to points on the boundary.

A polygon P is a 'star convex' polygon if and only if: $((\exists\, x \in P)$ such that $(\forall\, y \in P)), ((x, y) \in P)$. Where x and y are points and (x, y) is the line segment connecting x to y. Efficient algorithms for finding star convex polygons have implications to the "art gallery problem." In this presentation we show that under certain restrictions, including the requirements that the image object is star convex, the equal angel signature yields unique and highly compressible representation of the object. Moreover a variant of this representation is invariant to affine transformations and can be used for image recognition as well as image compression. Furthermore we show that the minimal enclosing star convex of an arbitrary object can be efficiently used for object representation in image recognition applications. Finally, we discuss algorithms for finding the minimal enclosing star convex polygon of an arbitrary image object.

Contributed Talks Session IX (CHSS 232)

Counting Subtrees: Enumerative and Extremal Questions

Hua Wang

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The subtrees of a tree have been studied from various points of view. In particular, the extremal trees that maximize the number of subtrees were identified for different categories of trees such as binary trees and trees with a given maximum degree. We extend these results to trees with given degree sequences. Furthermore, an ordering of the extremal trees with different degree sequence is provided. This ordering provides a relatively easy way to identify extremal trees. Some of the previously know results follow as corollaries.

In Search of a Strongly Directed Regular Graph

Jose Gamez

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A graph is a strongly directed regular graph if and only if the number of paths of length 2 from vertex x to vertex y is: λ, if there is an edge from x to y; μ, if there is not an edge from x to y (with $x \neq y$); and t, if $x = y$. If G is a group and S a subset of G, then the Cayley graph is the directed graph whose vertices are the elements of G, and directed edges are (g, gs) for every g in G and s in S.

We are searching for a directed strongly regular graph with the following parameters: $n = 28, k = 7, t = 2, \lambda = 1$ and $\mu = 2$. Since successful previously found graphs were Cayley graphs for their strong symmetry, we will use these graphs from the Dihedral group of order 28 as the empirical approach in solving the conjecture. We shall test all possible sets S through a computer program written in Mathematica in search for a Cayley graph that will satisfy the definition of a directed strongly regular graph.

Invited Lecture

Circulant Weighing Matrices of Small and Large Weight

Bernhard Schmidt

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We show that all circulant weighing matrices of weight bounded by a constant arise from what we call "irrducible orthogonal families" which can be enumerated by a finite algorithm. We also describe a new result on circulant weighing matrices of the largest possible weight, i.e., circulant Hadamard matrices, which settles the only known open case of the Barker sequence conjecture.

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