Contributed Papers
Communications libres
(Org: **Tatyana Foth** (Western))

AMAL AMLEH, Saint Mary's University
On Second-Order Rational Difference Equations

In this talk we present a summary of recent and new results on the global character of solutions of the second-order rational difference equation

$$x_{n+1} = \frac{\alpha + \beta x_n + \gamma x_{n-1}}{A + Bx_n + Cx_{n-1}}, \quad n = 0, 1, \ldots$$

with nonnegative parameters $\alpha, \beta, \gamma, A, B, C$ and with arbitrary nonnegative initial conditions x_{-1}, x_0 such that the denominator is always positive. Some extensions to higher-order rational difference equations will also be presented.

MICHAEL CAVERS, University of Regina, Department of Mathematics and Statistics, Regina, SK S4S 0A2, Canada
Reducible inertially arbitrary matrix patterns

An n by n nonzero (resp. sign) pattern $\mathcal{A}$ is a matrix with entries in $\{*, 0\}$ (resp. $\{+, -, 0\}$). The inertia of a matrix A is the ordered triple (a_1, a_2, a_3) of nonnegative integers where a_1 (resp. a_2 and a_3) is the number of eigenvalues of A with positive (resp. negative and zero) real part. $\mathcal{A}$ is inertially arbitrary if each nonnegative integer triple (a_1, a_2, a_3) with $a_1 + a_2 + a_3 = n$ is the inertia of a matrix with nonzero (resp. sign) pattern $\mathcal{A}$. Some observations regarding which inertias $\mathcal{A}$ and $\mathcal{B}$ may allow to guarantee $\mathcal{A} \oplus \mathcal{B}$ is inertially arbitrary are presented. It is shown that there exists non-inertially-arbitrary nonzero (resp. sign) patterns $\mathcal{A}$ and $\mathcal{B}$ such that $\mathcal{A} \oplus \mathcal{B}$ is inertially arbitary.

VIRGINIE CHARETTE, Université de Sherbrooke, Sherbrooke, QC
Affine deformations of the holonomy group of a three-holed sphere

Let T be a complete hyperbolic surface homeomorphic to a three-holed sphere and let G denote the image under the holonomy representation of its fundamental group. Identifying the group of hyperbolic isometries with an appropriate component of the group of isometries of Minkowski spacetime, we may consider affine deformations of G; we may ask, when does this affine deformation act properly discontinuously on R^3? An important invariant for affine isometries with non-elliptic linear part is the *Margulis invariant*, which is a measure of signed Lorentzian displacement. In this paper, we show that an affine deformation of G acts properly discontinuously if and only if the Margulis invariant is positive for each of the three isometries corresponding to the pant holes of T. More precisely, we show that such an affine deformation admits a fundamental domain.

This is joint work with Drumm and Goldman.

ALEXEI F. CHEVIAKOV, University of British Columbia, Vancouver, BC
Construction and Applications of Nonlocally Related Systems of Partial Differential Equations

For a given Partial Differential Equation (PDE) or a system of PDEs, with $n \geq 2$ independent variables, I will describe a systematic (and rather general) framework to find PDE systems *nonlocally related* to the given one. Such nonlocally related PDE systems have solution sets that are equivalent to the solution set of the given system (i.e., any solution of a nonlocally related system yields a solution of the given system, and, conversely, any solution of the given system yields a solution of the nonlocally related system). Moreover, the solution of any boundary value problem posed for the given PDE system is embedded in the solution of a boundary value problem posed for the nonlocally related (*potential*) system (and the converse also holds).

Due to nonlocal relations and the equivalence of solution sets, any general method of analysis (symmetry, conservation law, qualitative, perturbation, numerical, etc.), when applied to one of such nonlocally related PDE systems, can yield new results. In particular, new conservation laws, nonlocal symmetries and new exact solutions have been found for many nonlinear PDE systems arising in applications.

I will discuss several illustrative examples: the Nonlinear Wave equation, Planar Gas Dynamics equations, equations of Nonlinear Elastodynamics, and Plasma Equilibrium equations in 3D.

The talk is aimed at the broad audience of applied mathematicians and researchers working with PDE models.

This is a joint work with George Bluman.

FRANKLIN MENDIVIL, Math. Dept., Acadia University, Wolfville, NS
Annealing a GA for Constrained Optimization

We consider the problem of adapting a Genetic Algorithm (GA) to constrained optimization problems, using a dynamic penalty approach as a type of annealing. We present two different methods for ensuring almost sure convergence to a globally optimal (feasible) solution. The first of these involves modifying the GA operators to yield a Boltzmann-type distribution while the second incorporates a dynamic penalty along with a slow annealing of the acceptance probabilities.

PAUL POTGIETER, University of South Africa, Department of Decision Sciences, PO Box 392, Pretoria, 0003 South Africa
Large fluctuations of complex oscillations

Recent precise estimates on the frequency of occurrence of intervals of rapid growth on a Brownian path are discussed. These are then used, together with the theory of Gaussian algebras, to obtain similar estimates for the large fluctuations of complex oscillations, which can be seen as Brownian motion generated by the set of Kolmogorov–Chaitin complex strings. This yields the Hausdorff dimension of the rapid points of such complex oscillations.

FREYDOON RAHBARNIA, Ferdowsi University of Mashhad, Department of Mathematics, PO Box 1159, Mashhad 91775, Iran
Knots, Projections and Graphs

In this paper, we study graphs related to knots. We investigate the connection between knot projections and graphs. We use the related graphs to catalog knot projections.

YONGJUN XING, University of Regina, 3737 Wascana Parkway, Regina, SK S4S 0A2
On the Spread of Real Symmetric Matrices with Entries in an Interval

The spread of a matrix has extensive and practical applications in combinatorial optimization problems and cybernetics problems. There are many papers on the spread of a symmetric matrix, but restricting the entries of such $n \times n$ symmetric matrices to each lie in $[a, b]$ seems to be a new view of this problem. As a first step, we show that the entries must equal a or b in the case when the spread is maximum. Next, when the spread attains the upper bound of Mirsky's seminal result, we describe the structure of those matrices. Then we focus our study on the maximal value of the spread and the corresponding structure of the matrix that achieves the maximum spread over all real symmetric, $n \times n$ matrices, whose entries lie in a given interval. Matlab is used as a tool to aid the verification of some cases.