Contributed Papers
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(Org: **Ross Stokke** (Winnipeg))

NATALIA BRYKSINA, University of Manitoba, 240 Wallace Building, 125 Dysart Road, Winnipeg MB, R3T 2N2
On the number and stability of limit cycles in an SIR model with saturated incidence

We use the theory of Lyapunov coefficients to estimate the number, and characterize the stability, of limit cycles associated with an SIR model that employs saturated incidence function of the general form: $g(I) = kI^h/(1+\alpha I^h)$, where k, α and h are parameters. This study confirms that the model may have at most two limit cycles when $h = 2$. Furthermore, it is shown that for the case $h = 3$, the model may have a maximum of three limit cycles. The stability of these limit cycles is characterized based on the signs of the Lyapunov coefficients.

CHUANBIN DU, York University, 4700 Keele Street, Toronto, Ontario, M3J 1P3
Efficient splitting and domain decomposition methods for time-dependent problems and the applications

In this talk, we propose an efficient splitting domain decomposition method (S-DDM) for solving parabolic equations and study a splitting ELLAM for convection-dominated diffusion problems in high-dimensions. We apply the S-DDM scheme by incorporating the upstream methods to simulate the groundwater contaminant transport in porous media.

CAROLYN HUSTON, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 4S5
Finding the fish: Straying trends between BC Pacific herring (Clupea pallasi) populations

Herring tag data is available starting from 1936 in British Columbia. We are looking at herring stray rates between five geographically distinct populations defined by the Department of Fisheries and Oceans (DFO). We will create a multi-state population model to estimate yearly stray rates between populations. Based on deviances from these estimates we will identify years where there have been noticeable quantitative changes in herring stray behaviour. Hopefully these changes can be associated with recorded environmental indicators. Special consideration will be given to how to treat missing data resulting from both fishery closures and missed tagging events.

CHENG LIU, York
Stockwell Transform as the Instantaneous Frequency Estimator

Instantaneous frequency (IF) is a critical parameter in describing non-stationary signals whose frequency characteristics vary over time.

In real application, it is usually difficult to obtain accurate IF estimation of signals in terms of their multi-component feature and the presence of noise. One kind of popular and useful approach for measuring the IF is based on the property of time-frequency representation. In the talk, we give a short review about two basic techniques of them: peak detection method and the reassignment method. And then we extend such technique with the recently developed time-frequency representation: the Stockwell transform. The improvement of our new methodologies are shown by numerical simulations.

ODILE MARCOTTE, CRM, Université de Montréal, C.P. 6128, succ. Centre-ville, Montréal, Québec, H3C 3J7
Average Distance and Maximum Induced Forest

With the help of the Graffiti system, Fajtlowicz conjectured around 1992 that the average distance between two vertices of a connected graph G is at most half the maximum order of an induced bipartite subgraph of G, denoted $\alpha_2(G)$. We prove a strenghtening of this conjecture by showing that the average distance between two vertices of a connected graph G is at most half the maximum order of an induced forest, denoted $F(G)$. Moreover, we characterize the graphs maximizing the average distance among all graphs G having a fixed number of vertices and a fixed value of $F(G)$ or $\alpha_2(G)$. Finally, we conjecture that the average distance between two vertices of a connected graph is at most half the maximum order of an induced linear forest (where a linear forest is a union of chains).

This is joint work with Pierre Hansen (HEC Montréal) and Alain Hertz, Rim Kilani and David Schindl (Ecole Polytechnique de Montréal).

MICHAEL SKOTINIOTIS, University of Calgary, Institute for Quantum Information Science, 2500 University Drive NW, Calgary, Alberta, T2N 1N4
The Spekkens toy model Revisited

The Spekkens toy model is an interesting example of how to augment classical physics in order to perform several quantum informational tasks using limited resources. We revisit the Spekkens toy model and look at the different representations for the group of operations on a single toy bit. We show that in the representation of the operators as Euler rotations, there exist rotations that obey the knowledge balance principle, yet are not present in Spekkens' original group. We demonstrate that this expanded group of single toy bit operations, which includes Spekkens' original operations as a subgroup, is isomorphic to the extended Clifford group for one qubit (modulo scalar multiples of the identity). We also investigate the case for two toy bits again expanding the group of toy operations to include some, but not all, of the extended operations.

IICKHO SONG, KAIST, 373-1 Guseong Dong, Daejeon, Korea
On the number of partitions with the length fixed

In this talk, we will show that the number $M(n,k)$ of partitions of nonnegative integer n with k parts can be described by a set of $\widetilde{k}$ polynomials of order $k-1$ in $Q_{\widetilde{k}}$, where $\widetilde{k}$ denotes the least common multiple of $1,2,\ldots,k$ and $Q_{\widetilde{k}}$ is the quotient of n when divided by $\widetilde{k}$. In addition, the sets of the $\widetilde{k}$ polynomials are obtained explicitly for $k=3,4,5$, and 6.

JIE SUN, University of Alberta
Descent constructions for central extensions of infinite dimensional Lie algebras

We use Galois descent to construct central extensions of twisted forms of split simple Lie algebras over rings. These types of algebras arise naturally in the construction of Extended Affine Lie Algebras. The construction also gives information about the structure of the group of automorphisms of such algebras.

TAMAS TERLAKY, McMaster University, Hamilton, ON
Polytopes & Arrangements: Diameter & Curvature

It was shown recently that the central path can be bent along the simplex path of Klee–Minty cubes. This lead to tightening the iteration complexity bound of central path following interior point methods. Further, intriguing analogs between edge-paths and central paths arise. We conjecture that the order of the largest total curvature of the central path is the number of inequalities, and that the average diameter of a bounded cell of an arrangement is less than the dimension. We substantiate these conjectures and prove a continuous analog of the d-step conjecture.

Joint work with A. Deza, E. Nematollahi and Y. Zinchenko.

HONG YUE, Concordia University, 1455 de Maisonneuve Blvd. West, Montreal, QC, H4E 2A9
A John-Nirenberg Type Inequality for $\mathbf{Q}(\mathbf{R}^n)$

The John–Nirenberg inequality characterizes functions in the space BMO in terms of the decay of the distribution function of their oscillations over a cube [JN, 1961]. In joint work with Galia Dafni, we prove a John–Nirenberg type inequality for functions in the space $Q_\alpha(\mathbf{R}^n)$, which is a modified version of the conjecture by Essén, Janson, Peng and Xiao [EJPX, 2000]. We construct a function, as a counterexample, to show the necessity for this modification.

HU ZHANG, McMaster University, 1280 Main Street West, Hamilton, ON, L8S 4K1
Minimizing the Number of Critical Vertices in Network Design

Given a weighted complete graph $G_K(V, E_K)$, we study a network design problem to find an edge set $E \subseteq E_K$ such that the graph $G(V, E)$ is connected. The power of a vertex u in G is the maximum weight of the edges in E incident with it. Minimizing the maximum vertex power is polynomial time solvable, while minimizing the number of critical vertices with this minimized maximum vertex power is NP-hard. For any fixed $\epsilon > 0$ we present a $(3/2 + \epsilon)$-approximation algorithm for the latter problem, and show that this ratio is tight.