香港數學學會
The Hong Kong Mathematical Society

(Founded in 1979)

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**THE HONG KONG MATHEMATICAL SOCIETY**

**ANNUAL GENERAL MEETING 2013**

**8 June 2013 (Saturday)**

**9:00am - 5:20pm**

**LT-7, B5-208, B5-210, B5-211, (Academic 1)**
**The City University of Hong Kong**

Schedule of Events

**Venue: LT-7**

**Chair: Zhou-Ping Xin**

9:00am - 10:00am **HKMS Distinguished Lecture by Shing-Tung Yau (Harvard University)**

Title: From Vacuum Space to Space with Cosmological Constant

Abstract: In this talk, I shall discuss some part of geometry that is relevant to models of space time. Many of such models are proposed by our friends in physics to understand our universe.

10:00am – 10:30am Tea Break

10:30am - 10:50am HKMS Best Thesis Award Presentation Ceremony

**Chair: Ding-Xuan Zhou**

10:50am - 11:40am **Plenary Lecture by Stephen Wright (University of Wisconsin-Madison)**

Title: Optimization in Data Analysis

Abstract: Optimization techniques are critical for extracting useful information from large data sets. Optimization provides not only valuable tools for solving these problems, but also methods for formulating the problems, and alternative perspectives that may be unfamiliar and potentially useful for domain scientists. In this talk, we discuss several representative problem classes in data analysis. We describe optimization formulation techniques, especially regularization, which induces desired properties in the solution.

Finally, we outline the algorithmic approaches that have proved particularly useful, and which are an interesting blend of established techniques and fresh ideas.

**Chair: Nai Chung Conan Leung**

11:40am-12:30pm **Plenary Lecture by Jiu-Kang Yu (IMS, CUHK)**

Title: Zeta functions of higher dimensional analogues of regular graphs

Abstract: The Zeta function of a finite regular graph was defined by Ihara in the 60's, as a generating function counting geodesics. Ihara also showed that this function is rational, and its zeroes/poles carry important spectral information about the graph. Generalization of this to 2-dimension was achieved a few years ago by Kang and Li. I will present a higher dimensional analogue which is a joint work with M.H. Kang.

12:30pm - 2:00pm Lunch

**Venue: Room B5-208**

**Chair: Zhou-Ping Xin**

2:00pm - 2:30pm Council Annual General Meeting

**Invited talks (Parallel Sessions):**

**Venue: Room B5-208**
**Parallel Session 1: Geometry**
**Chair: Nai Chung Conan Leung**

2:30pm - 3:00pm **1. Yi Hu (University of Arizona)**

Title: Modular Blowups: a survey

Abstract: I will give a leisurely survey on modular blowups and their applications to Gromov-Witten theory of Calabi-Yau threefolds.

3:00pm - 3:30pm **2. Ye Fei (HKU)**

Title: Some Splitting Criteria for Vector Bundles and Reflexive Sheaves

Abstract: In this talk, I will present some splitting criteria for holomorphic vector bundles and reflexive sheaves and show how to use analytic method or algebraic method to prove them.

3:30pm - 3:50pm Tea Break

3:50pm - 4:20pm **3. James Fullwood (HKU)**

Title: On singularities in algebraic geometry and physics

Abstract: We review some fundamental invariants of singular algebraic varieties and discuss how many classical invariants have been generalized throughout the modern development of algebraic geometry. We then move on to discuss certain roles singular varieties have played in the development of string theory.

4:20pm - 4:50pm **4. Kwok Wai Chan (CUHK)**

Title: Mirror symmetry via SYZ

Abstract: Mirror symmetry is a mysterious phenomenon discovered by string theorists in the late 1980's. It asserts that the symplectic geometry of a Calabi-Yau manifold is "equivalent" to the complex geometry of its mirror Calabi-Yau manifold, and vice versa. In this talk, we will discuss an example of this mirror phenomenon and explain how one can understand the geometry underlying mirror symmetry via the famous Strominger-Yau-Zaslow (SYZ) conjecture.

**Venue: Room B5-210**

**Parallel Session 2: Applied Mathematics**
**Chair: Xiao-Ping Wang**

2:30pm - 3:00pm **1. Daomin Cao (Chinese Academy of Science)**

Title: Regularization of steady point vortex solutions to Euler equation in two dimension

Abstract: In this talk the speaker will review the study of regularization of steady point vortex solution of Euler equation. Concerning the existence of such solutions, it turns out that the so called Kirchhoff-Routh function plays an important role. The speaker will talk about some recent work of D. Smets and J. Van Schaftingen in which the existence of solutions concentrating near maximum points of Kirchhoff-Routh function is established. He will also talk about the improved results he obtained with Zhongyuan Liu and Juncheng Wei.

3:00pm - 3:30pm **2. Tiezheng Qian (HKUST)**

Title: Modeling and simulations for two-phase flows at solid surfaces: A Review

Abstract: I will give a review on the modeling and simulations for two-phase flows at solid surfaces, from immiscible two-phase flows with diffusion to one-component liquid-vapor flows with phase transition. The guiding principles for the theoretical formulation are from continuum mechanics and non-equilibrium thermodynamics. The validity of the models is conformed through quantitative comparison between continuum predictions and molecular dynamics simulations. Aiming at real world problems, these studies open up challenges and opportunities in both computation and analysis.

3:30pm - 3:50pm Tea Break

3:50pm - 4:20pm **3. Zhian Wang (PolyU)**

Title: Pattern formation of volume-filling chemotaxis models

Abstract: Chemotaxis describes the orientated movement toward the chemical concentration gradient. Classical Keller-Segel chemotaxis model exhibits the finite-time blowup behavior which has unfavorable relevance to biology. Hence a large amounts of efforts were made in the past a few decades to regularize the classical Keller-Segel model so that the regularized models allow the global bounded pattern solutions. Among these models, the volume-filling chemotaxis models, which assumes a priori threshold that cells cannot exceed due to the size effect of cells, have been widely used for mathematical studies and biological modelings. In this talk, I will briefly review the ideas

of the volume-filling chemotaxis models and present the recent theoretical studies on the pattern formation of volume-filling chemotaxis models with numerical simulations. Some open questions will be given.

4:20pm - 4:50pm **4. Xiang Zhou (CityU)**

Title: Theories and Algorithms of Saddle Search for Rare Event

Abstract: The search for these saddles is one of the most fundamental problems in understanding the rare events in metastable systems. We discuss recent progresses of our gentlest ascent dynamics and the iterative minimizing formulation for saddle search. They give an interesting mathematical formulation of saddles, and in algorithmic aspect, they provide a unified perspective of most existing popular algorithms as well as opportunities of more efficient new algorithms.

**Venue: Room B5-211**

**Parallel Session 3: Image Processing & Numerical Optimization**
**Chairs: Xiao-Jun Chen & Xiaoming Yuan**

2:30pm - 3:00pm **1. Henry Y.T. Ngan (HKBU)**

Title: Recent Image Processing Techniques on Automated Defect Detection for Patterned Textures

Abstract: Automated defect detection for patterned textures aims at detecting defects on the surfaces of the patterned textures during manufacturing. It helps to reduce human visual inspection errors and labor costs as well as to increase detection accuracy. It involves many image processing techniques, which attracts many attentions and researches from mathematics, engineering and industrial practitioners in the recent several decades. In this talk, we will review the recent developed defect detection methods under a framework of a motif-based concept. A motif is the fundamental unit of a patterned texture and is able to generate the whole patterned texture by pre-defined symmetry rules. The motif-based classification is based on the 17 wallpaper groups, defined by mathematicians, for all patterned textures in the world. Herein, methods of some main approaches of the non-motif-based methods for the p1 group (i.e. statistical, spectral, model-based, learning and structural approaches) will be addressed, while other methods for the other 16 groups (i.e. wavelet-processing golden image subtraction, Bollinger bands, Regular bands) will be presented. Lastly, the latest motif-based approach will be given.

3:00pm - 3:30pm **2. Xiaosheng Zhuang (CityU)**

Title: Sparse Approximation, Directional Multiscale Representation Systems, and Mathematical Imaging

Abstract: One of the main tasks in modern imaging and applied harmonic analysis is to construct suitable representation systems along with fast implementable algorithms for efficient decomposition and analysis of multidimensional data. It is by now well-know that a large class of multidimensional images is governed by anistropic features which can be modeled as the so-called "cartoon-like" image. In this talk, we shall focus on sparse approximation of cartoon-like images using directional multiscale representation systems, and mathematical imaging using l_1 minimization techniques. We shall discuss about one of the directional multiscale representation systems, namely shearlets,

its optimality in N-term approximation of cartoon-like images, and its digitization based on the fast pseudo-polar Fourier transform on pseudo-polar grids. We will also discuss about the application of compressed sensing and l_1 techniques in image inpainting. As an application of the l_1 minimization, we provide a quantitative result for comparison between wavelet inpainting and shearlet inpainting based on an appropriate model for seismic inpainting.

3:30pm - 3:50pm Tea Break

3:50pm - 4:20pm **3. Xile Zhao (University of Electronic Science and Technology of China)**

Title: Deblurring and Sparse Unmixing for Hyperspectral Images

Abstract: The main aim of this paper is to study total variation (TV) regularization in sparse unmixing of hyperspectral images. In the model we also incorporate blurring operators for dealing with blurring effects, and in particular, from atmospheric turbulence in space object remote sensing. An alternating directions method is developed to solve the resulting optimization problem efficiently. According to the structure of the total variation regularization and sparse unmixing in the model, the convergence of the alternating directions method can be guaranteed. Experimental results are reported to demonstrate the effectiveness of the TV and sparsity model and the efficiency of the proposed numerical scheme, and the method is compared to the recent Sparse Unmixing via variable Splitting Augmented Lagrangian and Total Variation (SUnSAL-TV) method by Iordache, Bioucas-Dias, and Plaza.

4:20pm - 4:50pm **4. Wei Bian (Harbin Institute of Technology)**

Title: Complexity Analysis of Interior Point Algorithms for Non-Lipschitz and Nonconvex Minimization

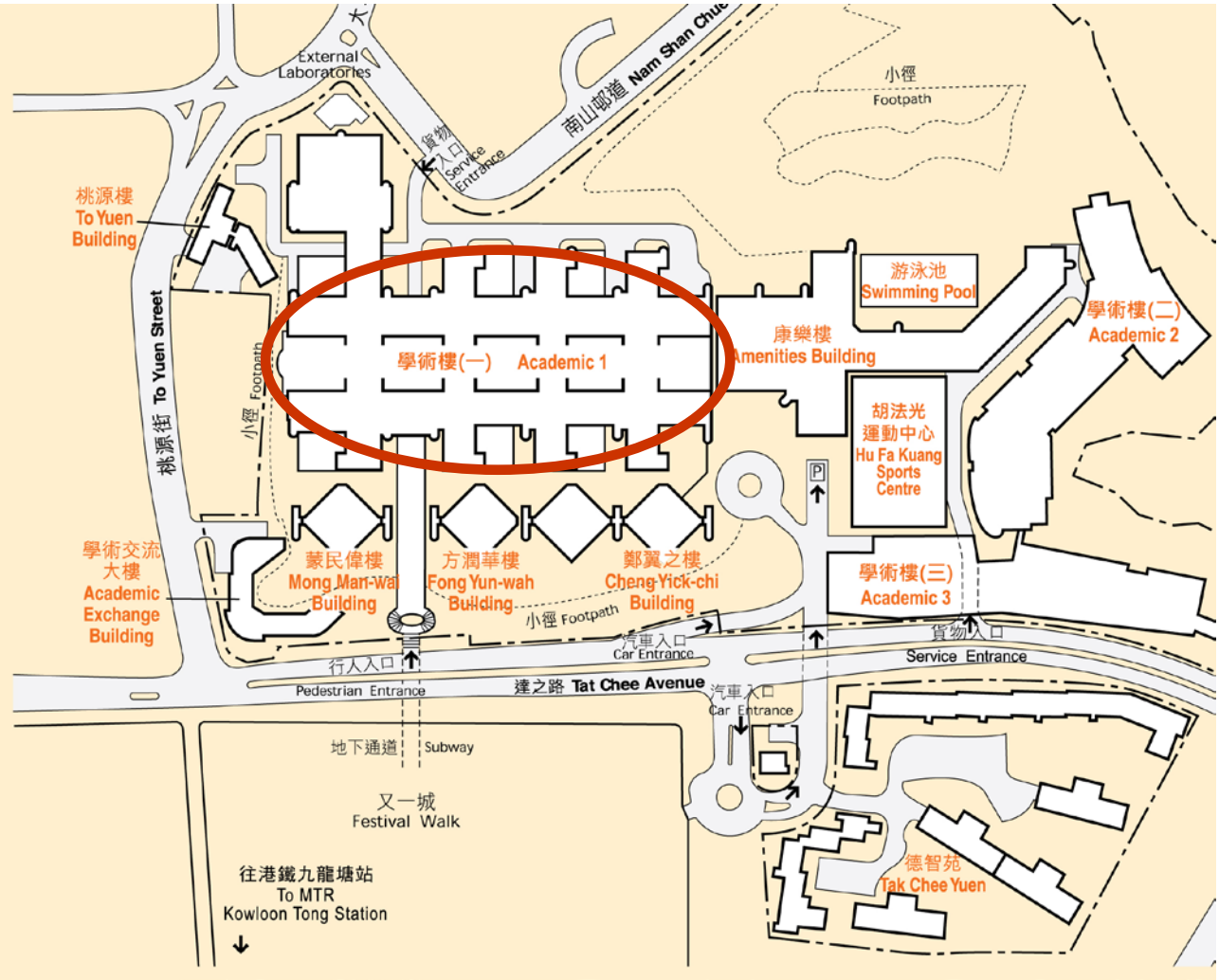
Abstract: We propose a first order interior point algorithm for a class of non-Lipschitz and nonconvex minimization problems with box constraints, which arise from applications in variable selection and regularized optimization. The objective functions of these problems are continuously differentiable typically at interior points of the feasible set. Our first order algorithm is easy to implement and the objective function value is reduced monotonically along the iteration points. We show that the worst-case iteration complexity for finding an ε scaled first order stationary point is O (ε^-2). Furthermore, we develop a second order interior point algorithm using the Hessian matrix, and solve a quadratic program with a ball constraint at each iteration. Although the second order interior point algorithm costs more computational time than that of the first order algorithm in each iteration, its worst-case iteration complexity for finding an ε scaled second order stationary point is reduced to O(ε^{-3/2}). Note that an ε scaled second order stationary point must also be an ε scaled first order stationary point.

4:50pm - 5:20pm **5. Boshi Tian (PolyU)**

Title: An Interior-Point $\ell_{\frac12}$-Penalty Method for Nonlinear Optimization

Abstract: In this presentation, we study inequality constrained nonlinear programming problems by using a lower order $\ell_{\frac12}$-penalty function and a quadratic relaxation. Combining with an interior-point method, we propose an interior-point $\ell_{\frac12}$-penalty function method. Using some extended constraint qualifications, we obtain first-order optimality conditions for the relaxed lower order \ell_{\frac12}$-penalty problems. We apply the modified Newton method to a sequence

of logarithmic barrier problems, and design some robust algorithms. We carry out numerical experiments for three test problem sets, which contain small scale and medium scale test problems, large scale test problems and optimization problems with different kinds of degenerate constraints, respectively. Our numerical results show that our method is competitive with other existing interior-point $\ell_1$-penalty methods in term of iteration numbers and is more reliable when the error between the computed objective function and the best known objective function value is considered




*Location for Academic 1, City University of Hong Kong*

*This event is co-organized with Department of Mathematics, City University of Hong Kong.*