

The 2019 Symposium for Young Analysts

May 31, 2019

Program:

May 31, 2019 (Fri)
M107, Hong-Jing Hall, NCU

9 : 00—9 : 20

Registration

9 : 20—9 : 30

Opening

9 : 30—10 : 10

Title : *Random Operator Theory: Some Results and More Questions*

Xiang Fang

(Department of Mathematics, NCU)

10 : 10—10 : 40

Title: *An Introduction to the Ising model*

Badr Elkamash

(Department of Mathematics, NCU)

10 : 40—11 : 00

Break

11 : 00—11 : 30

Title: *An Introduction to Brownian local times*

Le Hoai Nhan

(Department of Mathematics, NCU)

11 : 30—12 : 00

Title: *Mandelbrot Set and Julia Sets*

Kuo Li-Feng

(Department of Mathematics, NCU)

12 : 00—13 : 30

Lunch

13 : 30—14 : 00	Title: <i>Local mean oscillation and A2 conjecture</i> Hsu Chun-Bao (Department of Mathematics, NTU)
14 : 00—14 : 30	Title: TBA Ching-Hsien Lee (Department of Mathematics, NTU)
14 : 30—15 : 00	Title: <i>How to repesent Hilbert transform by Haar shift</i> Chih-Chieh Hung (Department of Mathematics, NTU)
15 : 00—15 : 30	Break
15 : 30—16 : 00	Title: <i>The weak solutions near vacuum for compressible Euler equations</i> Hsin-Yi Lee (Department of Mathematics, NCU)
16 : 00—16 : 30	Title: <i>A supercritical estimate for Bessel potentials on Lorentz spaces</i> You-Wei Chen (Department of Applied Mathematics, NCTU)
16 : 30—17 : 10	Title: <i>Harmonic analysis in Australia</i> Xuan Thinh Duong (Department of Mathematics, Macquarie University, Australia)
18 : 00	Banquet

(5/31 Fri. 09 : 30 — 10 : 10)

Random Operator Theory: Some Results and More Questions

Xiang Fang

Department of Mathematics, NCU

Abstract: Random Matrix Theory (RMT) has evolved into a remarkably sophisticated subject, yet much less is known for its infinite dimensional counterpart, namely, Random Operator Theory (ROT). Moreover, our knowledge on ROT so far is devoted (almost) exclusively to self-adjoint and unbounded differential operators, such as random Schrodinger operators. A theory for non-selfadjoint and bounded ROT is largely missing so far. This report is on some of our initial efforts to explore this untapped area. In particular, we introduce and study a clearly fundamental yet unexplored model, which we call “random weighted shifts”. Other models, such as random Hardy/Bergman spaces, random Toeplitz operators, random coefficient multipliers, random Carleson measures, etc., are proposed, but we have more questions than answers.

(Joint work with Cheng Guozheng and Zhu Sen.)

(5/31 Fri. 10 : 10 — 10 : 40)

An Introduction to the Ising model

Badr Elkamash

Department of Mathematics, NCU

Abstract: The Ising model has been a subject for research since its outcome. In the era of Information Technology and with better computational abilities the simulations based on a lattice, using the Ising model, have been increased a lot. We will initially provide some definitions and examples about Ising model. Then we will calculate the model in one dimension and two dimension. And how results have been obtained from this, i.e. the evaluation of the system's behavior.

An Introduction to Brownian local times

Le Hoai Nhan

Department of Mathematics, NCU

Let $W = (W_t)_{t \in \mathbb{R}_+}$ be a Wiener process, $M = (M_t)_{t \in \mathbb{R}_+}$ be its running maximum, and $T = (T_a)_{a \in \mathbb{R}}$ be the hitting times process. We will prove that for almost every ω , the zero set of W ,

$$C_\omega = \{t \in \mathbb{R}_+ : W_t(\omega) = 0\}$$

has features like the Cantor set. That is, C_ω is a perfect, unbounded set with empty interior and zero Lebesgue measure and has the power of the continuum. Then, base on the relationship of M and the Wiener process W with $|V| = M - W$, we will show the existence of the local time process L of W at 0, where L is the process satisfies the set of time of increase for L_ω is C_ω . Finally, we also show that the inverse of the local time is a stable Levy process with index 1/2 and give the definition of local time at $x \in \mathbb{R}$.

(5/31 Fri. 11 : 30 — 12 : 00)

Mandelbrot Set and Julia Sets

Kuo Li-Feng

Department of Mathematics, NCU

Abstract: We will study the iteration of complex polynomials and introduce Julia sets, Fatou sets and the Mandelbrot set. We will discuss their properties. We will present many simulations via python.

(5/31 Fri. 13 : 30 — 14 : 00)

Local mean oscillation and A2 conjecture

Hsu Chun-Bao

Department of Mathematics, NTU

Abstract: All currently known proof of A2 conjecture were based on the representation of T in terms of the Haar shift operator.

In this talk, I'll introduce a new method to avoid completely the notion of the Haar shift operator, and it is based on the "local mean oscillation decomposition", and in general, this method is relatively simple.

(5/31 Fri. 14 : 00 — 14 : 30)

TBA

Ching-Hsien Lee

Department of Mathematics, NTU

How to represent Hilbert transform by Haar shift

Chih-Chieh Hung

Department of Mathematics, NTU

Abstract: In Harmonic Analysis, we concerned with the boundedness of operators such as Hilbert transform, Riesz transform, or more general operators: the CZOs (Calderon-Zygmund operators). In last century, we have already known the boundedness of CZO is L^p to L^p .

Next we moved to weighted version for the same questions, which has been solved in 1970s. In particular, some questions arising from PDE and other areas, we need to know the sharp boundedness. This problem has been solved by Tuomas Hytönen in 2010 by using Haar shift to represent any CZO. In this talk, We will discuss that how to represent Hilbert transform (the simplest CZO) by Haar shift. This method is based on Stefanie Petermichl.

The weak solutions near vacuum for compressible Euler equations

Hsin-Yi Lee

Department of Mathematics, NCU

Abstract: In this talk, we investigate the existence and behavior of weak solutions near vacuum for compressible Euler equations. We consider the Riemann and generalized Riemann problems to the leading-order equations from Euler equations, which form a nonlinear decoupled resonant system. For the Riemann problem, we observe the appearance of vacuum state and delta-shocks depending on the wave speeds. This indicates that the Riemann solver is not appropriate for the building block of generalized Glimm scheme. We invent the regularized Riemann solver to control the bound of total variations for solutions. The composite hyperbolic waves are observed from the regularized Riemann solver. The stability of such solver is also established.

(Joint work with Shih-Wei Chou, Chia-Chieh Jay Chu, John M. Hong)

A supercritical estimate for Bessel potentials on Lorentz spaces

You-Wei Chen

Department of Applied Mathematics, NCTU

Abstract. In this talk we prove a new estimate for Bessel potentials acting on Lorentz space in the supercritical exponent: Let $1 < p = \frac{d}{\alpha-1}$ and $1 \leq q \leq +\infty$. If $f \in L^{p,q}(\mathbb{R}^d)$, then there exists a constant $C = C(\alpha, d, p, q)$ such that

$$|g_\alpha * f(x) - g_\alpha * f(z)| \leq C|x - z| (|\ln(|x - z|)| + 1)^{\frac{1}{q'}} \|f\|_{L^{p,q}}.$$

Keywords. Bessel potential, Lorentz Space, Fractional Integration Inequality.

(5/31 Fri. 16 : 30 — 17 : 10)

Harmonic analysis in Australia

Xuan Thinh Duong

Department of Mathematics, Macquarie University, Australia

Abstract: We give some main feature of research in harmonic analysis in Australia, in particular at Macquarie University, Sydney. We will also give information concerning the PhD scholarships at Macquarie and other universities in Australia.