BGSU Department of Mathematics and Statistics

BOWLING GREEN STATE UNIVERSITY

Weekly Calendar – Spring Semester 2025
Week 6 – February 17 – 21

Monday, February 17	**Presidents Day Open House** 9:30am – 2:30pm, McLeod Hall 459 *Presidents Day -- Open House is an annual event for prospective undergraduate students. Please join us to welcome our visitors and to answer their questions about mathematics and statistics classes, careers and other opportunities at BGSU.* **Meeting with Graduate Dean** 2:00pm – 3:00pm, McLeod Hall 400 **Math 1190 Instructor Meeting** 3:00pm – 4:00pm, McLeod Hall 459
Tuesday, February 18	**TTF Candidate Teaching Presentation** 9:00am – 9:30am, McLeod Hall 459 Topic: Candidate's choice from professional actuarial exams **TTF Candidate Open Meeting with Faculty/Graduate Students** 9:45am – 10:45am, McLeod Hall 459 **Graduate Student Seminar** 12:00pm – 12:45pm, McLeod Hall 459 Speaker: Tanmoy Rudra Title: Filters and Ultrafilters in Metric Spaces **TTF Candidate Open Meeting with Faculty/Graduate Students** 1:30pm – 2:15pm, McLeod Hall 459 **TTF Candidate Research Presentation** 2:30pm – 3:30pm, McLeod Hall 459 Topic: Bridging the Disaster Protection Gap with Index Insurance

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Wednesday, February 19	**Geometry and Topology Seminar** 12:00pm – 1:00pm via Zoom link TBA Speaker: Swarup Bhowmik, Institute of Engineering and Management, Kolkata, India Title: Quasi-Isometry Group of the Euclidean Space **Analysis Reading Seminar** 2:30pm – 3:30pm, McLeod Hall 459 Speaker: Salma Hasannejad Title: Universal Functions for the Composition Operator, Part 2 **Advisory Committee** 3:30pm – 4:30pm, McLeod Hall 400
Thursday, February 20	**TTF Candidate Teaching Presentation** 9:00am – 9:30am, McLeod Hall 459 Topic: Candidate's choice from professional actuarial exams **TTF Candidate Open Meeting with Faculty/Graduate Students** 9:45am – 10:45am, McLeod Hall 459 **TTF Candidate Open Meeting with Faculty/Graduate Students** 2:30pm – 3:00pm, McLeod Hall 459 **TTF Candidate Research Presentation** 3:15pm – 4:15pm, McLeod Hall 459 Topic: Fractional Gaussian Processes: Innovating Actuarial Risk Modeling and Risk Management
Friday, February 21	**Peer Mentor Seminar** 3:30pm – 5:15pm, McLeod Hall 240 **Colloquium** 3:45pm – 5:00pm McLeod Hall 459 Speaker: Louis Hainaut, University of Chicago Title: Patterns in the Homology of Moduli Spaces of Punctured Surfaces

ABSTRACTS

Geometry and Topology Seminar

Title: Quasi-isometry group of the Euclidean space

Abstract:

The notion of quasi-isometry is one of the fundamental concepts in geometric group theory. For a given metric space X, the group of quasi-isometries from X to itself is denoted as $QI(X)$ and serves as a quasi-isometric invariant of X. It is well-knowm that when Γ is a finitely generated group, a choice of finite generating set S gives the word metric d_S on Γ, making it a metric space. Then one can talk about the quasi-isometry group $QI(\Gamma)$ and it can be shown that $QI(\Gamma)$ does not depend on the choice of S. However, the determination of $QI(\Gamma)$ for arbitrary groups remains a challenging task, and very limited knowledge is available concerning these groups in general. Even for $\Gamma = \mathbb{Z}^n$, $QI(\mathbb{Z}^n)(\cong QI(\mathbb{R}^n))$ remain largely unexplored, especially for $n > 1$, though some attempts have been made in [1] and [3]. In [4], an explicit description of any quasi-isometries of the real line was presented, employing piecewise-linear homeomorphisms with specific conditions on their slopes. In this research article, we extend this study by providing combinatorial criterion that determine when a piecewise-linear homeomorphism of $\mathbb{R}^n$ qualifies as a quasi- isometry. To achieve this, we establish conditions related to vertices and edges of a triangulation of $\mathbb{R}^n$ that are sufficient to determine whether a piecewise-linear homeomorphism of $\mathbb{R}^n$ is a quasi-isometry.

In recent times left-orderability and locally indicability of a group are drawing the attention of many researchers since the left-orderable groups, left-invariant orders on groups and locally indicable groups have strong connections with algebra, dynamics and topology. It is known that every locally indicable group is left orderable; it was an open question whether the converse was true. In [2], the author came up with a counterexample.

[1] S. Bhowmik, P. Chakraborty, : A combinatorial criterion and center for the quasi-isometry groups of Euclidean spaces. Accepted in *Topology and its Applications.*

[2] S. Bhowmik, P. Chakraborty, : A structure theorem and left-orderability of a quotient of quasi-isometry group of the real line. *Geom Dedicata* 218, 12 (2024).

[3] O. Mitra, P. Sankaran, : Embedding certain diffeomorphism groups in the quasi-isometry groups of Euclidean spaces, *Topology Appl.*, **265**(2019), 11pp.

[4] P. Sankaran, : On homeomorphisms and quasi-isometries of the real line. *Proc. of the Amer. Math. Soc.*, **134** (2005) 1875-1880.

TTF Candidate Research Presentation (Tuesday)

Topic: Bridging the Disaster Protection Gap with Index Insurance

Abstract: Natural disasters have become increasingly frequent and severe, leading to sharply rising financial costs in recent decades. Yet, the insurance protection gap remains substantial, with over 60% of global economic losses left uninsured between 2012 and 2021. Index insurance, a relatively new approach, offers a potential solution by providing payouts based on pre-specified indices, which can be quickly calculated and made available post event. Unlike traditional indemnity insurance, which involves high adjustment costs and lengthy delays in claims settlement, index-based contracts can significantly reduce both costs and settlement times while offering critical protection against catastrophic events. This raises the question: can index insurance complement indemnity insurance in bridging the disaster protection gap? While promising, index insurance faces the challenge of basis risk-the discrepancy between the index used and the actual losses experienced. This paper introduces a conceptual framework that theoretically demonstrates how proper index design can reduce basis risk and increase insurance take-up. Our empirical analysis focuses on flood insurance. By leveraging rich, yet complex, weather data and advanced deep learning techniques, we develop a modeled index designed to forecast ultimate flood losses while reducing basis risk. Specifically, to capture the intricate effects of compound weather events, we propose a neural-network based predictive model. This model features a recurrent neural network with an attention mechanism to capture the temporal dynamics of weather data, complemented by a feedforward network to handle nonlinear dependencies and complex interactions between weather variables and static information. We show that the proposed index achieves a 20.0% reduction in basis risk compared to the benchmark neural network model-based index without weather inputs. Furthermore, reducing the loading on the index boosts insurance take-up by an additional 3.4%, generating a welfare gain of $16.6 per consumer. These findings offer valuable insights for policymakers, insurers, and policyholders on how risk management innovations can enhance disaster resilience.

TTF Candidate Research Presentation (Thursday)

Title: Fractional Gaussian Processes: Innovating Actuarial Risk Modeling and Risk Management

Abstract: Stochastic models driven by Brownian motion are widely used across various disciplines within actuarial science. Fractional Gaussian processes, as an emerging approach in actuarial literature, offer increased flexibility to model long-range dependence and roughness features in risks faced by actuaries. In this talk, I will introduce the stochastic analysis and statistical inference results for fractional Gaussian processes and highlight two important applications in actuarial risk modeling. One application concerns the use of the Ornstein-Uhlenbeck process driven by mixed fractional Brownian motion in longevity risk management. The second explores the impact of fractional volatility models on the actuarial valuation of equity-indexed annuities. Similar to Brownian motion, further developments in fractional Gaussian processes are expected to advance risk sciences.

Colloquium

Title: Patterns in the Homology of Moduli Spaces of Punctured Surfaces

Abstract: Let $\mathcal{M}_{g,n}$ be the moduli space of Riemann surfaces of genus g with n punctures. In joint work with Nir Gadish we computed some classes in the homology of $\mathcal{M}_{2,n}$, and we observed in particular that some of these classes are described by the Whitehouse modules. In the first part of this talk I will introduce the spaces $\mathcal{M}_{g,n}$ and motivate the study of these spaces and of their homology; then in the second part I will introduce the main results towards our computations of homology classes.