



THE HONGKONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINARS ON APPLIED MATHEMATICS

By

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Talk 1	<p><i>Dimensional Analysis and Universal Scaling Laws: A Journey from Historical Foundations to Contemporary Research</i></p> <p>Abstract: The seminar will provide an in-depth look at dimensional analysis, tracing its evolution from historical origins to modern uses in various scientific fields. We'll begin with a brief historical overview, highlighting key contributors and milestones that have significantly influenced the development of dimensional analysis. The core portion of the presentation will focus on Buckingham's Π theorem and its role in creating dimensionless groups that lead to universal scaling laws. We will examine several classic examples of dimensional analysis, such as Taylor's $2/5$ law in point blast and Kolmogorov's $3/5$ law in turbulence, to demonstrate its wide-ranging applicability. I will also discuss my research, which extends dimensional analysis to new areas, including a generalized version of Kepler's 3rd law, the dynamics of domino falls, dandelion seed dispersion, compressible turbulence, the Tesla valve's fluid mechanics, and fish locomotion strategies. The seminar aims to highlight the fundamental principles uniting these diverse applications and showcase dimensional analysis as a powerful tool for scientific understanding and engineering innovation. The session will conclude by considering the future of dimensional analysis in the context of big data and computational advancements, encouraging interdisciplinary collaboration and continued exploration.</p>
Talk 2	<p><i>Möbius Inversion and Its Application in Physics: Unveiling the Harmony Between Number Theory and Physical Phenomena</i></p> <p>Abstract: The seminar will delve into the intriguing overlap between number theory and physics, particularly through the application of Möbius inversion, a mathematical technique that has profound implications in physical theories. We will start by discussing the Möbius function, detailing its roots in number theory and its transformative impact on the analysis of mathematical sequences. We'll trace the origins of Möbius inversion back to its namesake, August Ferdinand Möbius, a 19th-century German mathematician whose work laid foundational stones in number theory. The seminar will highlight how Möbius inversion helps connect fundamental numerical functions like the divisor function and the sum-of-divisors function. Further, we will explore how Möbius inversion is utilized in physics, specifically in studying phenomena such as black-body radiation and applications within the framework of the Boltzmann equation. The session will wrap up with a discussion on the challenges and opportunities of applying Möbius inversion in physical contexts, emphasizing its potential to spur future interdisciplinary research. Participants will leave with an enriched understanding of how mathematical techniques like Möbius inversion not only clarify complex physical concepts but also bridge the gap between distinct scientific disciplines.</p>

Date : 17 May 2024 (Friday)

Time : 10:00a.m. – 12:30p.m.

Venue : Room 1410 (Lifts 25/26)

All are Welcome!