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THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON APPLIED MATHEMATICS

Algorithms and Theories of Diophantine Errors

By

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Abstract

Numbers underpin mathematical research and our understanding of natural phenomena. The real number system consists of rational numbers—a measure-zero set—and irrational numbers—a full-measure set. It thus follows that systems governed by irrational numbers are more prevalent. However, modern computers cannot store or represent irrational numbers exactly. This renders numerical computations for irrational-dominated systems prone to Diophantine errors, incurred when approximating irrationals with rationals. Such errors can significantly compromise numerical results. In this talk, we analyze the mechanism of Diophantine error and its impact on numerical computation. We also develop an approximation theory for multi-dimensional quasiperiodic functions with Diophantine frequencies, when approximated by periodic functions. To avoid Diophantine errors, we propose two novel algorithms: the projection method and the finite points recovery method. These extend high-precision numerical computation from the rational to the real domain. Leveraging the ergodic and arithmetic properties of irrational numbers, we establish the mathematical foundations of these algorithms. Finally, we present their applications to several scientific problems.

Date : 03 January 2026 (Saturday)

Time : 10:30a.m.- 11:30a.m.

Venue : Room 1409 (Lift 25/26)

All are Welcome!