THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON PURE MATHEMATICS

Algebraic Constructions of De Bruijn-Type Structures in Grids and Grassmannians

by

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Abstract

De Bruijn sequences compactly encode all fixed-length strings over a finite alphabet in a single cycle, with broad applications in coding, pseudorandomness, and combinatorics. This talk presents two algebraic generalizations.

First, we construct De Bruijn tori—two-dimensional toroidal arrays over finite fields where each nonzero subarray appears exactly once. Using field traces and multiplicative structure, we develop efficient constructions based on Kronecker products and recursive updates.

Second, we explore De Bruijn-type cycles on Grassmannians, where each pair of consecutive vectors spans a distinct 2-dimensional subspace of Fqn. Through cross-ratio invariants and Möbius actions, we construct such cycles under coprimality or controlled repetition, depending on the field and dimension.

These results unify combinatorial designs with algebraic tools, enabling efficient traversal and encoding of high-dimensional structures.

Date : **09 July 2025 (Wednesday)**
Time : **4:00p.m.-5:00p.m.**
Venue : **Room 2463 (Lift 25/26)**

All are Welcome!