

Cluster Algebra School

Lecture series

Speaker: Eunjeong Lee (Chungbuk National University)

Title: An informal invitation to cluster algebras

Abstract: Cluster algebras were introduced by Sergey Fomin and Andrei Zelevinsky as an algebraic framework for understanding total positivity and dual canonical bases arising in semisimple groups. Since then, the theory has developed into a common language connecting algebra, combinatorics, geometry, and representation theory. One of the central attractions of the theory is that a simple local operation, called mutation, can reveal unexpected positivity, symmetries, and geometric structures.

This three-day lecture series will provide an introductory overview of cluster algebras, based primarily on “Introduction to Cluster Algebras” by Fomin, Williams, and Zelevinsky. The emphasis will be on concrete examples and visual and combinatorial models.

On the first day, we will cover Chapters 1–4. We will begin with total positivity, one of the original motivations for the theory, and then introduce quiver and matrix mutation, clusters and seeds, and the Laurent phenomenon. We will also examine triangulations and wiring diagrams as visual models for mutation.

On the second day, we will cover Chapters 5–6. We will discuss the classification of cluster algebras of finite type and its connection with Dynkin diagrams. We will then turn to cluster structures on commutative rings. Important examples will include the coordinate rings of SL_k and $Mat_{k \times k}$, as well as the homogeneous coordinate rings of Grassmannians.

On the third day, we will cover Chapter 7 and study the combinatorics of plabic graphs, their associated quivers, and the local moves relating them. We will explain how triangulations and wiring diagrams fit naturally into the framework of plabic graphs and introduce Grassmann necklaces and weakly separated collections.

Main references

- S. Fomin, L. Williams, and A. Zelevinsky, Introduction to Cluster Algebras:
- Chapters 1–3, arXiv:1608.05735.
 - Chapters 4–5, arXiv:1707.07190.
 - Chapter 6, arXiv:2008.09189.
 - Chapter 7, arXiv:2106.02160.

Research talks

Speaker: Byung Hee An (Kyungpook National University)

Title:

Abstract:

Speaker: Myungho Kim (Kyung Hee University)

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