

Advertisement: Bachelor's Thesis

Topic: The container method

Supervisor: Prof. Dr. Stefan Glock

Description: The container method is a powerful technique in modern combinatorics. The main theorem is formulated in terms of independent sets of uniform hypergraphs whose edges are sufficiently evenly distributed. Strikingly, those independent sets are clustered, which means one can find a family of so-called containers with the following key properties: every independent set is contained in some container, every container is close to being independent, and the total number of containers is small. This has found numerous applications in extremal graph theory, Ramsey theory, additive combinatorics, and discrete geometry.

Thesis goals: The aim of this project is to survey the container method, to present in detail the short proof of Nenadov and Pham, and to demonstrate applications to the above mentioned areas.

Main articles:

- J. Balogh, R. Morris, W. Samotij, The method of hypergraph containers, Proceedings of the International Congress of Mathematicians (ICM 2018), pp. 3059–3092.
- R. Nenadov and H. T. Pham, Short proof of the hypergraph container theorem, Combinatorics, Probability and Computing 34 (2025), 621–624.

Further reading:

- D. J. Kleitman and K. J. Winston, On the number of graphs without 4-cycles, Discrete Mathematics 41 (1982), 167–172.
- M. Schacht, Extremal results for random discrete structures, Annals of Mathematics 184 (2016), 333–365.