

# Foreword

This book collects the material delivered in the 2008 edition of the *DocCourse in Combinatorics and Geometry* which was devoted to the topic of *Additive Combinatorics*.

The two first parts, which form the bulk of the volume, contain the two main advanced courses, *Additive Group Theory and Non-unique Factorizations*, by Alfred Geroldinger, and *Sumsets and Structure*, by Imre Z. Ruzsa.

The first part focusses on the interplay between zero-sum problems, arising from the Erdős–Ginzburg–Ziv theorem, and nonuniqueness of factorizations in monoids and integral domains.

The second part deals with structural set addition. It aims at describing the structure of sets in a commutative group from the knowledge of some properties of its sumset.

The third part of the volume collects some of the seminars which accompanied the main courses and covers several aspects of contemporary methods and problems in Additive Combinatorics: multiplicative properties of sumsets (Christian Elsholtz), a step further in the inverse  $3k - 4$ -theorem (Gregory A. Freiman), the isoperimetric method (Yahya O. Hamidoune), new developments around Følner's theorem (Norbert Hegyvári), the polynomial method (Gyula Károlyi), a survey on open problems (Melvyn B. Nathanson), spectral techniques for the sum-product problem (Jozsef Solymosi), and multidimensional inverse problems (Yonutz V. Stanchescu).

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Coordinators of the DocCourse

Combinatorial Number Theory and Additive Group  
Theory

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