Combinatorial design theory is a source of simply stated, concrete, yet difficult discrete problems, with the Hadamard conjecture being a prime example. It has become clear that many of these problems are essentially algebraic in nature. This book provides a unified vision of the algebraic themes which have developed so far in design theory. These include the applications in design theory of matrix algebra, the automorphism group and its regular subgroups, the composition of smaller designs to make larger designs, and the connection between designs with regular group actions and solutions to group ring equations. Everything is explained at an elementary level in terms of orthogonality sets and pairwise combinatorial designs—new and simple combinatorial notions which cover many of the commonly studied designs. Particular attention is paid to how the main themes apply in the important new context of cocyclic development. Indeed, this book contains a comprehensive account of cocyclic Hadamard matrices. The book was written to inspire researchers, ranging from the expert to the beginning student, in algebra or design theory, to investigate the fundamental algebraic problems posed by combinatorial design theory.

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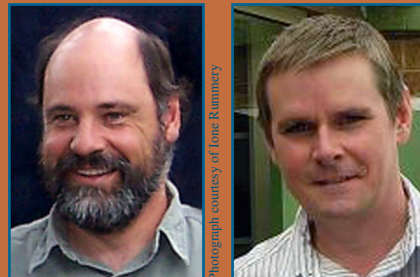
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Algebraic Design Theory

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Algebraic Design Theory

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