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Gerhard O. Michler
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Theory of Finite Simple Groups

This book provides the first representation theoretic and algorithmic approach to the theory of abstract finite simple groups. Together with the cyclic groups of prime order the finite simple groups are the building blocks of all finite groups. The theory presented here is built on the intimate relations between general group theory, ordinary character theory, modular representation theory and algorithmic algebra. Each of these theories is developed in this book from scratch.

The author then applies these theories to present proofs of classical and new group order formulas, and a new structure theorem for abstract finite simple groups. This, and the famous Brauer–Fowler theorem, provides the theoretical background for the author's algorithm which constructs all finite simple groups G having a 2-central involution z with a given centralizer $C_G(z) = H$ as matrix groups over finite fields. It also determines their conjugacy classes and character tables.

The theory and algorithms have concrete applications and the author demonstrates this by constructing all the simple satellites of the known simple groups which are not uniquely determined by a given centralizer H. Uniform existence and uniqueness proofs are given for the modern sporadic simple groups discovered by Janko, Higman and Sims, Harada, and Thompson. This latter result due to Weller, Previtali and the author proves a longstanding open problem in the theory of finite simple groups. These applications show that the methods developed in this book can be used efficiently to calculate matrix representations, permutation representations and character tables of large groups.

GERHARD MICHLER is an Emeritus Professor of the Institute of Experimental Mathematics at the University of Duisburg-Essen, and Adjunct Professor at Cornell University.

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Theory of Finite Simple Groups

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To my wife

WALTRAUD

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