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Recently, it became apparent that a large number of the most interesting structures and phenomena of the world can be described by networks. Developing a mathematical theory of very large networks is an important challenge. This book describes one recent approach to this theory, the limit theory of graphs, which has emerged over the last decade. The theory has rich connections with other approaches to the study of large networks, such as "property testing" in computer science and regularity partition in graph theory. It has several applications in extremal graph theory, including the exact formulations and partial answers to very general questions, such as which problems in extremal graph theory are decidable. It also has less obvious connections with other parts of mathematics (classical and non-classical, like probability theory, measure theory, tensor algebras, and semidefinite optimization).

This book explains many of these connections, first at an informal level to emphasize the need to apply more advanced mathematical methods, and then gives an exact development of the algebraic theory of graph homomorphisms and of the analytic theory of graph limits.