Topics in topology contains no results due to the author, but many results are given new proofs and the topics discussed have been put in a modern context. Another distinguishing feature of this book is that it is completely self-contained. The proofs of all results are given into such detail that they should be accessible to a beginning graduate or an advanced undergraduate student. The book is suitable as a textbook for an advanced graduate course in topology. The treatment of each topic is supplemented by a discussion of further directions of research and a selected bibliography. There is a plenitude of exercises of varying difficulties. The exercises have been suitably chosen to illustrate the techniques introduced and also to provide a glimpse of further research topics.

The selected topics are presented in an original way, so that even a researcher already familiar with the results covered here may find reading this book worth while.

ILIJAS FARAH

Department of Mathematics, York University, Toronto, ON M3J 1P3, Canada.
ifarah@mathstat.yorku.ca.

R. G. DOWNEY and M. R. FELLOWS. ***Parameterized complexity.*** Monographs in computer science. Springer, New York, Berlin, and Heidelberg, 1999, xv + 533 pp.

Parameterized complexity is a branch of complexity theory that gives a framework for a refined complexity analysis of hard algorithmic problems. The basic idea can best be explained by an example: Consider the problem of evaluating a sentence of a given language (a query) in a finite structure (a relational database). This problem usually has a high complexity (depending on the language, of course, but the problem is NP-complete even for the very basic primitive sentences—conjunctive queries). The main factor contributing to this complexity is the length of the query. In practice, however, queries are usually short, certainly much shorter than the size of the database. Thus when analyzing the complexity of the problem one should put much more emphasis on the size of the database than on the length of the query. An algorithm evaluating a query of length k in a database of size n in time $O(2^k \cdot n)$ is therefore much better than one performing the same task in time $O(n^{k/2})$, although both are exponential. Parameterized complexity provides a framework to pursue this distinction.

Parameterized complexity theory studies problems whose instances are *parameterized* by some function of the input whose values are natural numbers, such as the length of the query in the example. The idea is to choose the parameterization in such a way that it can be assumed to take small values for the instances one is interested in. A parameterized problem is *fixed-parameter tractable* if there is an algorithm solving it in time $f(k) \cdot n^c$, where n denotes the size of the input, k is the parameter, and where $f : \mathbb{N} \to \mathbb{N}$ is a computable function and $c > 0$ is a constant. The class of fixed-parameter tractable problems is denoted by FPT. Parameterized complexity theory provides methods for proving problems to be in FPT, but also gives a framework for dealing with apparently intractable problems.

Parameterized complexity theory has been developed in the last ten years; ideas from that theory have found their way into various areas of computer science, such as artificial intelligence, computational biology, and database theory. The basic definitions and concepts were introduced by R. G. Downey and M. R. Fellows, the authors of the monograph under review. They—sometimes with other authors—developed large parts of the theory and of its applications.

The book is divided into three parts. The first part is devoted to parameterized tractability. It presents various methods to show that a given problem is in FPT and applies these methods to a variety of problems. For example, Chapter 3 explains the method of bounded search trees and the method of problem kernel. Both can be used to show that Vertex Cover, parameterized by the size of the vertex cover, is in FPT. Chapter 6 and Chapter 7 present methods based on automata, bounded tree-width, and on Robertson and Seymour's graph minor