3. L. Boutet de Monvel, *On the index of Toeplitz operators of several complex variables*, Invent. Math. **50** (1979), 249–272.
4. R. Coifman and Y. Meyer, *Au delà des opérateurs pseudodifférentiels*, Astérisque **57** (1979), 1–184.
5. H. Cordes, *On compactness of commutators of multiplications and convolutions, and boundedness of pseudodifferential operators*, J. Funct. Anal. **18** (1975), 115–131.
6. H. Cordes and E. Herman, *Gelfand theory of pseudo-differential operators*, Amer. J. Math. **90** (1968), 681–717.
7. R. Douglas, *C*-algebra extensions and K-homology*, Ann. of Math. Studies, No. 95, Princeton Univ. Press, Princeton, N. J., 1980.
8. J. Duistermaat, *Fourier integral operators*, Courant Inst. Lecture Notes, New York, 1974.
9. V. Guillemin and S. Sternberg, *Geometric asymptotics*, Math. Surveys, no. 14, Amer. Math. Soc., Providence, R. I., 1977.
10. L. Hörmander, *Pseudo-differential operators and hypoelliptic equations*, Proc. Sympos. Pure Math., vol. 10, Amer. Math. Soc., Providence, R. I., 1966, pp. 138–183.
11. ______, *The Weyl calculus of pseudodifferential operators*, Comm. Pure Appl. Math. **32** (1979), 359–443.
12. R. Howe, *On the role of the Heisenberg group in harmonic analysis*, Bull. Amer. Math. Soc. (N.S.) **3** (1980), 821–843.
13. T. Kato, *Boundedness of some pseudo-differential operators*, Osaka J. Math. **13** (1976), 1–9.
14. A. Nagel and E. Stein, *Lectures on pseudo-differential operators: Regularity theorems and applications to non-elliptic problems*, Math. Notes, Princeton Univ. Press, Princeton, N. J., 1979.
15. G. Pedersen, *C*-algebras and their automorphism groups*, Academic Press, London, 1979.
16. I. Singer, *Some remarks on operator theory and index theory*, Proc. Conf. on K-Theory and Operator Algebras (Athens, Georgia), Lecture Notes in Math., no. 575, Springer-Verlag, New York, 1977, pp. 128–138.

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Dimension theory, by Ryszard Engelking, North-Holland Mathematical Library, Vol. 19, North-Holland Publishing Company, Amsterdam and New York; Polish Scientific Publishers, Warsaw, 1978, x + 314 pp., $44.50.

Geometry lays claim to being the oldest mathematical discipline. The notion of dimension is fundamental to geometry, but was without adequate rigorous underpinnings until the twentieth century. The early work of dimension theorists culminated in *Dimension theory* by W. Hurewicz and H. Wallman in 1941. Here the intuitive concepts of dimension were given precise definition and a complete theory for finite-dimensional separable metric spaces was given in an elegant and succinct form. There were many areas which remained to be investigated. One could argue that there should exist a comparable theory for general metric spaces. Within a few years such a theory was mapped out. J. Nagata's book, *Modern dimension theory*, relates the essential features of this theory. The intervening years have given us only minor embellishments. Dimension theory for nonmetrizable spaces is at the present time in a very unsatisfactory state, but for a different reason than in the past. Today we know that a satisfactory theory does not exist. Even compact spaces have proven perverse. Only Lebesgue covering dimension has yielded what might be called a theory for compact spaces. However, even in this case there is no comparison of this theory with the elegant dimension theory for separable metric or general metric spaces. Dimension theory in general spaces is a badlands of rocks and crevasses. There is a certain rugged beauty in the landscape, but there is little danger that any more than a few will be enticed deeply into this terrain.

It is important that the serious student in topology be familiar with the general results in dimension theory. For the student with a purely geometrical bent, Hurewicz and Wallman is the recommended guide. The one who wants an encyclopedic reference would probably choose A. R. Pears' *Dimension theory of general spaces*. There are many between these two extremes. For them Engelking's *Dimension theory* is an ideal text. It gives the background in separable metric spaces in a reasonable way and exposes the student to enough of the theory for nonmetrizable spaces for him to learn to keep his wits about him when facing problems in this difficult area.

One can use the book to serve as text in a course which is relatively deep and lasts a full year. This would require using all four chapters of the text. It could also be used for a one semester course in dimension theory for separable metric spaces. Such a course would use only the first chapter of the book. It is also possible to use just the first and last chapters in a course on dimension for general metric spaces. This would probably require two quarters for suitably prepared graduate students.

Engelking has one advantage over Hurewicz and Wallman. There are excellent exercises at the end of each section. (Exercises are totally lacking in Hurewicz and Wallman.) Many of the exercises come from classic papers in the area and many are nontrivial. Hints are given where appropriate. For very difficult problems the hints are quite detailed and will be appreciated by anyone not fanatically determined to do it himself. Well, you can ignore the hints if you want. Flores' example showing that the n-skeleton of the $(2n + 2)$-simplex cannot be embedded in R^{2n} is among the exercises. I recommend the hint here.

Too often mathematics is presented without proper regard for the history of the ideas involved. Engelking is refreshingly different. The historical and bibliographical notes are not only accurate and informative, but a delight to read as well. There is even mention of "heated discussions" concerning priority in defining the notion of dimension. L. E. J. Brouwer was embroiled in this controversy with P. Urysohn. Compared with other controversies in which Brouwer was involved this one was of little importance and mainly a matter of personal vanity. (By contrast Brouwer's controversies concerning the foundations of mathematics were of cosmic proportions.) By relating this relatively minor controversy Engelking gives us a glimpse of real people molding the history of mathematics, people whose temperaments were not always subject to the same discipline as their precise minds.

Engelking also gives the student a good introduction to dimension theory for nonmetrizable spaces. He devotes one of the four chapters of the book to large inductive dimension and one to covering dimension. He shows good taste in his choice of examples and theorems. What is not covered in detail is taken up in the exercises and historical notes. The notes are up to date. M. L. Wage's recent example of a normal space Z with $\text{Ind } Z = 0$, $Z \times Z$ normal, and $\text{Ind}(Z \times Z) > 0$ is mentioned as well as J. Walsh's infinite-dimensional compact metric space with no finite-dimensional subsets. (This is an improvement of D. Henderson's example which had no *closed* finite-dimensional subsets.)

From this book the student gets a good idea where dimension theory stands today. The lack of research questions indicates that this area may have passed its most fruitful period of research. The few remaining questions don't hold much prospect of giving us significantly new insights. New theorems and interesting examples will continue to appear, but it is unlikely that anything will arise to alter our basic perceptions of this theory. As with most theories which reach this state of maturity new ideas simply cannot find a place in the old theory. They must begin their life as a new theory and require a new classification.

Dimension theory is an excellent text giving us traditional dimension theory as it stands today. It presents all the essential features of interest to the general topologist without being compulsive. We have here a text that will probably be up to date for a considerable time.

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Representations of finite Chevalley groups, by Bhama Srinivasan, Lecture Notes in Math., vol. 764, Springer-Verlag, Berlin, Heidelberg, 1979, ix + 177 pp., $11.80.

The finite Chevalley groups are, roughly, the groups that arise when the real or complex parameters in a simple Lie group or, more generally, in a reductive one, are suitably replaced by the elements of a finite field. They include most of the finite simple groups, all except the alternating groups and the 26 "sporadic" groups, according to the classification which has just been completed. They thus occupy a central position in finite group theory. One of the important problems concerning them is the determination of their complex irreducible representations and characters. The first contribution here was made in 1896 by Frobenius **[1]** who determined the characters of the group $G = SL_2(k)$ over a finite field k. He first found the conjugacy classes of G, which is quite easy, and then built up the character table (a square matrix with rows indexed by conjugacy classes and columns by irreducible characters) by calculations not using much more than the orthogonality relations that this table was known to have. In 1907 Schur **[2]** redid Frobenius' work in a more conceptual way, obtaining many of the characters via concrete representations induced from one-dimensional representations of B, the group of upper-triangular matrices in G; but for those irreducible representations they cannot be obtained in this way, he, like Frobenius, could determine only the characters. This deficiency was soon noticed by others,