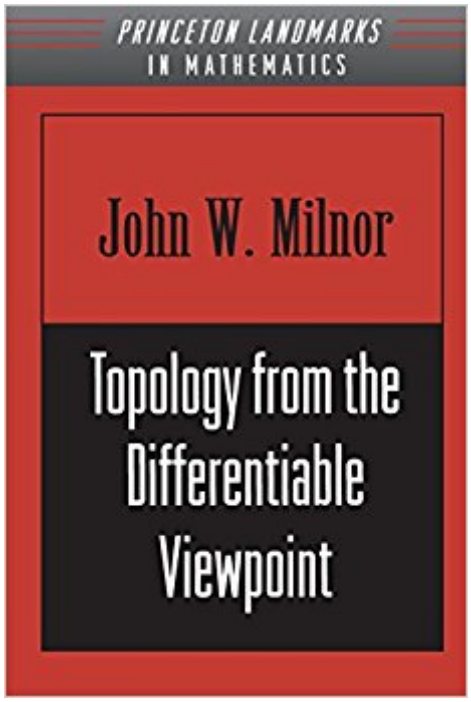
Topology From The Differentiable Viewpoint



Synopsis

This elegant book by distinguished mathematician John Milnor, provides a clear and succinct introduction to one of the most important subjects in modern mathematics. Beginning with basic concepts such as diffeomorphisms and smooth manifolds, he goes on to examine tangent spaces, oriented manifolds, and vector fields. Key concepts such as homotopy, the index number of a map, and the Pontryagin construction are discussed. The author presents proofs of Sard's theorem and the Hopf theorem.

Book Information

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Customer Reviews

I consider myself to be a pretty lousy graduate student and I still found this book to be very readable. This book is also cheap enough that you may want keep an extra copy around, as it makes a great gift item/stocking stuffer.

Milnor's "Topology from the Differentiable Viewpoint" is a brief sketch of differential topology, well written, as are all books by Milnor, with clear, concise explanations. For students who wish to learn the subject, it should be read as a companion to a more substantive text, such as Guillemin & Pollack'sÃ Â Differential TopologyÃ Â or Hirsch'sÃ Â Differential Topology, as too much of the material is left out for this to be adequate as a textbook. OTOH, it does make for good bedtime reading.While this book is highly regarded among mathematicians, it is not without its faults,

namely,- it fails to cover many topics of importance, such as transversality (only mentioned in an exercise), embeddings, differential forms, integration, Morse theory, and the intersection form;- it only cites some theorems without proving them, or it leaves the proofs to the reader;- it offers proofs of many theorems that are really only sketches without all the details;- manifolds are only defined as subsets of Euclidean spaces;- there is only 1 collection of 17 problems at the end of the book, which are used to introduce important concepts; and- it probably moves too quickly for true beginners, packing a lot into only 51 pages.So don’t buy this as your only, or even first, book on differential topology. Oddly, many of the faults that I listed above are simultaneously strengths, in that it can be read very quickly, with relatively little effort and a high rate of retention. Milnor really emphasizes the topology of the subject, giving applications such as the fundamental theorem of algebra, Brouwer’s fixed point theorem, the hairy ball theorem, the Poincare-Hopf theorem, and Hopf’s theorem. Most of the book focuses on degree theory, but there is also a nice introduction to framed cobordism, which is rare for an elementary book. Guillemin & Pollack’s book was based in large part on this one, and could be read together, with G&P giving more elementary explanations and additional topics, while Milnor’s book provides a proof of the Sard theorem and the Pontrjagin-Thom construction. The exercises, though not particularly difficult, do provide a good opportunity to practice proving theorems in the subject, as there are no hints for them, as one would find in many other differential topology books, and they are not separated by chapter.

This book packs a lot of interesting material into a small volume. E.g., I picked up another book recently that started talking about cobordisms right off the bat; despite my having a couple of shelves full of well-known Dover, Springer, Cambridge UP etc. books on topology, differential geometry, mathematical physics, etc., Milnor’s tiny book was the only one I found that could help me understand what cobordisms are right away. The book also uses many illustrations to help understanding.I demote this to 4 stars only because Princeton UP’s price is a bit high; many years ago I was lucky enough to find a used copy of the old U. Virginia edition, and paid much less.

I would suggest to use this book as a companion to more serious books on topology. Weighing in at a mere 51 pages, this book accomplishes what it needs to: a brief, succinct introduction to topology mostly based on the work of Brouwer. There is a nice mixture of topics, ranging from Sard’s theorem to Poincare-Hopf theorem. The proofs and ideas are not fully rigorous or developed, but that would be quite a bit to expect from such a short exposition.

Despite the lovely subject matter covered in this book, it more importanty gives one a taste of Mathematics as an intellectual discipline. It in outline shows how a mathematical theory - in this case Differential Topology - is constructed and consquently what mathematicians actually do and think about.Anyone who would like to appreciate Mathematics as a field of study rather than just learn some math should open this book.Better still, the prerequisite is only multivariate calculus!I have long thought this book should be the third year of calculus rather than differential equations or complex analysis.Additionally, for the novice it is the only entry I know of into the mysteries of high dimensional geometry, that amazing almost unbelieveable accomplishment of the human mind.There is a Star Trek episode in which a blind woman wears a dress of sensors which enable her to know more about her environment than a person can know from seeing. She knows exact distances and dimensions, can detect minute movements, can process the complete spectrum of light. In some sense she sees better. Modern topology and geometry are like that sensor dress for seeing higher dimensions. While we can not visualize the sphere in 5 dimensions, we know more about it from these mathematical theories than a five dimensionally sighted being ever could.Today, mathematics is often considered to be just a practical tool - like a spread sheet - or a toaster oven. We forget its power to widen our imagination, to frame the unimaginable. This book reminds us of this and shows why Mathematics is the Queen of Sciences.

This book is exceptionally well written and contains almost no errors. In this book, Milnor makes the decision to only treat the ideal cases. He does not delve into technical refinements. As a result, Milnor is able to prove a major theorem on almost every page. This also makes the book an ideal introduction for someone who is encountering differential topology for the first time since the reader is able to digest the key ideas in differential topology without having to go through extra technical baggage, which is required to extend the methods to more general cases. Despite the fact it is less than 80 pages, the book covers a significant amount of material, which allows the reader to learn a considerable amount per unit time.

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