Intuitive Topology

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Intuitive Topology
V V Prasolov
Universities Press (India) Ltd.
1998, Price: Rs.85

Topology is usually taught in India in the second year of a master's degree programme. Much of the time is spent on developing such basic notions as connectedness, compactness, product topology, and the course ends with Tychonov's theorem or Urysohn's lemma. At best, the student learns a bit about the fundamental group and covering spaces. But the teacher is well aware that point-set topology is but one aspect of the subject and that some of the major branches of topology such as homology and homotopy theory, differential topology, low dimensional topology, etc., are left completely untouched. On the other hand, popular science articles on topology usually describe some select problems in topology such as the Jordan curve theorem, the Brouwer fixed point theorem, the Königsberg bridge problem, the four colour theorem and so on. But no serious attempt has been made, (to my knowledge), to impart a flavour of the subject to undergraduate students that conveys some idea of what topology really is beyond, set topology. V V Prasolov, in his book under review, has made a bold attempt at this, and what is more, his book is accessible even to students at senior secondary school level. Indeed, as the author says in the preface, the book grew out of his lectures at a high school in Moscow.

The book appeals to the reader's intuitive understanding of such concepts as deformations, continuity, isotopy, etc. There are plenty of examples and problems to help one's understanding of the various concepts dealt with. The book is beautifully illustrated with over 150 figures and these are indispensable for one's understanding of the subject, given the informal way the material is presented. Often the solution to a problem is given pictorially!

The book has nine chapters in all, on knots, links and surfaces. Chapters 1–4 cover deformations, knots and links, spanning surface of knots and links, knot diagrams and their colourings. In these chapters one learns many interesting facts about knots and links. The author's selection of examples makes the subject very fascinating. For example the author's discussion on Borromean rings and tips for mountaineers as a possible application should make interesting reading.

Chapter 5 deals with homeomorphisms of surfaces. From chapter 6 onwards the material and the presentation becomes fairly sophisticated and more demanding on the reader. By now theorems begin to appear at regular intervals and proofs, though at times diagram dependent, become more and more rigorous. Chapter 6 introduces the notion of a vector field on the plane. Here he proves the Brouwer fixed point theorem for the two dimensional

disk and the Fundamental Theorem of Algebra. The author deals with vector fields on surfaces in chapter 7. Here it is shown that the sum of the indices at singularities of a vector field (with only isolated singularities) on the two-sphere equals 2. He also proves a similar theorem for a genus g surface, i.e., the surface obtained by attaching g handles to a two dimensional sphere. As an application, the author obtains the famous formula due to Euler, namely, $V - E + F = 2$, where V, E, F denote the number of vertices, edges, and faces respectively of a convex polyhedron in three-space. Chapter 8 is on fixed point free and periodic homeomorphisms where one learns how to construct fixed point free maps and homeomorphisms with specified periods on certain surfaces. The last chapter, chapter 9, is mostly a collection of problems on surfaces (with solutions).

This book should be in every college library. It will definitely be inspiring for very talented high school students. But I would expect that most students at the high school level will find it tough going beyond chapter 4 or 5. Some of the problems are hard. Although solutions are given, one might still be unconvinced and this may disturb the young reader. But complete and rigorous proofs at this stage are simply not possible. Remember, this is only a book on 'Intuitive topology'. Indeed the main purpose of such books is to arouse the curiosity of the reader for the subject; it is not intended to be a substitute for the conventional type of course, which develops the subject in a systematic and rigorous manner.

In conclusion, this book is highly recommended for talented high school students and for undergraduate students. The more mature graduate student will also benefit from reading this book as she will not have seen much of the material in her standard topology course.

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Watching the Weather

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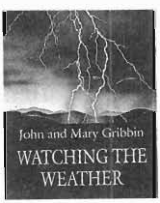

Watching the Weather
John and Mary Gribbin
Universities Press, 1998, Rs.120.

This book is based on regular contributions by the authors to the 'Weatherwatch' column of the British newspaper *Guardian*. The book contains a large number of short pieces on various facets of weather and climate. The authors are renowned for their ability to convey complex ideas in science in a simple and readable manner. This book is a pleasure to read and contains interesting nuggets of information. It is both entertaining and informative. It can be read by anyone with an interest in weather and climate.

The introductory chapter provides a good