Preface

The author wished to write a book that is relatively elementary and intuitive but rigorous without being too technical. This book exposes the connection between the low-dimensional orbifold theory and geometry that was first discovered by Thurston in 1970s providing a key tool in his proof of the hyperbolization of Haken 3-manifolds. Our main aims are to explain most of the topology of orbifolds but to explain geometric structure theory only for the 2-dimensional orbifolds.

The book was intended for the advanced undergraduates and the beginning graduate students who understand some differentiable manifold theory, Riemannian geometry, some manifold topology, algebraic topology, and Lie group actions. But we do include sketches of these theories in the beginning of the book as a review. Unfortunately, some familiarity with the category theory is needed where the author cannot provide a sufficiently good introduction.

This book is intentionally made to be short as there are many extensive writings on the subject already available. Instead of writing every proof down, we try to explain the reasoning behind the proofs and point to where they can be found. This was done in the hope that the readers can follow the reasoning without having to understand the full details of the proof, and can fast-track into this field. The book hopefully is self-sufficient for people who do not wish to delve into technical details but wish to gain a working knowledge of the field.

In this book, we tried to collect the theory of orbifolds scattered in various literatures for our purposes. Here, we set out to write down the traditional approach to orbifolds using charts, and we include the categorical definition using groupoids. We think that understanding both theories is necessary.

Computer experimentation is important in this field for understanding and research. We will also maintain a collection of Mathematica packages at our homepages so that the readers can experiment with them. We will also give addresses where one can find the computational packages. Many links will be gone soon enough but something related will reappear in other places.

This book is based on the courses that the author gave in the fall term of 2008 at Tokyo Institute of Technology as a visiting professor and in the spring term of 2011 at KAIST. I thank very much the hospitality of the Department of

Mathematical and Computing Sciences at Tokyo Institute of Technology. I thank David Fried, William Goldman, Craig Hodgson, Steve Kerckhoff, Hyuk Kim, Sadayoshi Kojima, Walter Neumann, Alan Reid, William Thurston, and many others not mentioned here for introducing me the ideas of orbifolds and geometric structures on them. Some of the graphics were done with Jfig© and Mathematica™ using the PoincareModel package from the Experimental Geometry Lab of the University of Maryland, College Park, written by William Goldman available from `http://egl.math.umd.edu/` and also the Curved Space by Jeffrey Weeks avaliable from `http://geometrygames.org/CurvedSpaces/index.html`. We also thank Gye-Seon Lee and Kanghyun Choi for drawing many of the graphics using these packages. I also thank many of my colleagues for much patience while this book was being written down. We also thank the anonymous referees for suggesting a number of improvements. The future revisions and errata will be available from `http://mathsci.kaist.ac.kr/~schoi/MSJbook2012.html`. Please send any comments to the author. Finally, this author was partially supported by the Mid-career Researcher Program through the NRF grant funded by the MEST under the grant number 2010-0027001.

Daejeon, July 2012 Suhyoung Choi