Preface

This English edition differs from the Russian original by the addition of a new chapter. In this new Chapter 3 we give an account of the theory of train tracks for automorphisms of free groups, which was developed in the seminal paper of M. Bestvina and M. Handel [9]. Our exposition is more algebraic than in this paper, but it is less technical than the account in the book [29] of W. Dicks and E. Ventura. In Section 10 of Chapter 3 we consider two examples in detail. We have added an appendix containing the famous Perron–Frobenius Theorem on nonnegative matrices, which is used in this chapter. Also we have added solutions to selected exercises.

The reader is assumed to have the knowledge of algebra expected after the first semester of university (permutations, fields, matrices, vector spaces; see [23], [39] or [55].

My sincere thanks go to Derek Robinson for invaluable help with the translation of this book and for useful comments that helped to improve the exposition. I also like to thank Hans Schneider and Enric Ventura for their suggestions on the improvement of the appendix and Chapter 3. Last but not least, I thank my wife Marie-Theres for her constant support.

Dortmund, January 2008 O. Bogopolski

Preface to the Russian Edition

This book is an extended version of a course given by me at Novosibirsk University from 1996 to 2001. The purpose of the book is to present the fundamentals of group theory and to describe some nontrivial constructions and techniques, which will be useful to specialists. The fundamentals are given in Sections 1–9 of Chapter 1; also one can read Chapters 1 and 2 independently.

In Chapter 1 we quickly introduce beginners to the classification of finite simple groups. It is shown that such complicated combinatorial objects as the Mathieu group M_{22} and the Higman–Sims group HS have a natural geometric description. In Section 17 we describe the relationship between Mathieu groups and Steiner systems with coding theory.

In Chapter 2 we describe the Bass–Serre theory of groups acting on trees. This theory gives a clear and natural explanation of many results about free groups and free constructions. We also explain the theory of coverings: the attentive reader will see a bridge from one theory to the other. I hope that numerous examples, exercises and figures will help to give a deeper understanding of the subject.

The reader is assumed to have the knowledge of algebra expected after the first semester of university (permutations, fields, matrices, vector spaces; see [39]). In addition, the fundamentals of group theory (especially abelian, nilpotent and solvable groups) can be read in the excellent book of M. I. Kargapolov and Ju. I. Merzljakov [38].

I thank many colleagues whose comments helped to improve the content and exposition of the material presented in this book. In particular I thank V. G. Bardakov, A. V. Vasiljev, E. P. Vdovin, A. V. Zavarnitzin, V. D. Mazurov, D. O. Revin, O. S. Tishkin and V. A. Churkin.

I thank M.-T. Bochnig for the help in designing this book.

Novosibirsk, May 11, 2002 O. Bogopolski