

Contents

1	Introduction	5
1.1	Applications of Graph Coverings	6
1.2	Complexity Aspects	8
1.3	Our Results	10
2	Definitions and Preliminaries	13
2.1	Automorphisms and Groups	13
2.2	Graph Coverings	15
2.3	Fundamental Complexity Properties of Graph Coverings	17
2.4	Overview of the Main Steps	21
3	Structural Properties of Atoms	25
3.1	Block-trees and Their Automorphisms	25
3.2	Definition and Basic Properties of Atoms	27
3.3	Symmetry Types of Atoms	31
3.4	Automorphisms of Atoms	33
4	Graph Reductions and Quotient Expansions	37
4.1	Reducing Graphs Using Atoms	38
4.2	Quotients and Their Expansion	45
5	Meta-algorithm	53

5.1	Testing Expandability Using Dynamic Programming	54
5.2	Proof of The Main Theorem	62
5.3	More Details about Star Atoms and Their Lists	64
6	Applying the Meta-algorithm to Planar Graphs	77
6.1	Automorphism Groups of 3-connected Planar Graphs	77
6.2	Primitive Graphs and Atoms for Planar Graphs	79
6.3	Planar Graphs Satisfy (P0) to (P3)	82
7	Concluding Remarks	85
7.1	Possible Extensions of The Meta-algorithm	85
7.2	Open problems	85