

## Contents

---

	<i>Preface to the third edition</i>	<i>page xi</i>
	<i>Preface to the first edition</i>	xiii
	<i>List of notation</i>	xvii
	<b>Introduction</b>	<b>1</b>
<b>1</b>	<b>Graphs</b>	<b>9</b>
	Abstract graphs and realizations	9
	★ Kirchhoff's laws	14
	Maximal trees and the cyclomatic number	16
	Chains and cycles on an oriented graph	20
	★ Planar graphs	26
	★ Appendix on Kirchhoff's equations	35
<b>2</b>	<b>Closed surfaces</b>	<b>38</b>
	Closed surfaces and orientability	39
	Polygonal representation of a closed surface	45
	★ A note on realizations	47
	Transformation of closed surfaces to standard form	49
	Euler characteristics	55
	★ Minimal triangulations	60
<b>3</b>	<b>Simplicial complexes</b>	<b>67</b>
	Simplexes	67
	Ordered simplexes and oriented simplexes	73
	Simplicial complexes	74
	Abstract simplicial complexes and realizations	77
	Triangulations and diagrams of simplicial complexes	79
	Stars, joins and links	84

Cambridge University Press

978-0-521-15405-5 - Graphs, Surfaces and Homology, Third Edition

Peter Giblin

Table of Contents

[More information](#)

viii

*Contents*

	Collapsing	88
	★ Appendix on orientation	93
<b>4</b>	<b>Homology groups</b>	<b>99</b>
	Chain groups and boundary homomorphisms	99
	Homology groups	104
	Relative homology groups	112
	Three homomorphisms	121
	★ Appendix on chain complexes	124
<b>5</b>	<b>The question of invariance</b>	<b>127</b>
	Invariance under stellar subdivision	128
	★ Triangulations, simplicial approximation and topological invariance	133
	★ Appendix on barycentric subdivision	136
<b>6</b>	<b>Some general theorems</b>	<b>138</b>
	The homology sequence of a pair	138
	The excision theorem	142
	Collapsing revisited	144
	Homology groups of closed surfaces	149
	The Euler characteristic	154
<b>7</b>	<b>Two more general theorems</b>	<b>158</b>
	The Mayer–Vietoris sequence	158
	★ Homology sequence of a triple	167
<b>8</b>	<b>Homology modulo 2</b>	<b>171</b>
<b>9</b>	<b>Graphs in surfaces</b>	<b>180</b>
	Regular neighbourhoods	183
	Surfaces	187
	Lefschetz duality	191
	★ A three-dimensional situation	195
	Separating surfaces by graphs	198
	Representation of homology elements by simple closed polygons	200
	Orientation preserving and reversing loops	203
	A generalization of Euler’s formula	207
	★ Brussels Sprouts	211
	<b>Appendix: abelian groups</b>	<b>215</b>
	Basic definitions	215
	Finitely generated (f.g.) and free abelian groups	217

Cambridge University Press

978-0-521-15405-5 - Graphs, Surfaces and Homology, Third Edition

Peter Giblin

Table of Contents

[More information](#)

---

	<i>Contents</i>	ix
	Quotient groups	219
	Exact sequences	221
	Direct sums and splitting	222
	Presentations	226
	Rank of a f.g. abelian group	233
	<i>References</i>	239
	<i>Index</i>	243