

Jose Luiz Fiadeiro

# **Categories for Software Engineering**

4y Springer

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	The Social Life of Objects	1
1.2	Categories Versus Sets	3
1.3	Overview of Typical Application Areas	5
1.4	What Can Be Found in This Book	9
 <b>Part I Basics</b>		
<b>2</b>	<b>Introducing Categories</b>	<b>15</b>
2.1	Graphs	15
2.2	Categories	20
2.3	Distinguished Kinds of Morphisms	27
<b>3</b>	<b>Building Categories</b>	<b>31</b>
3.1	Some Elementary Operations	31
3.2	"Adding Structure"	33
3.3	Subcategories	37
3.4	Eiffel Class Specifications	43
3.5	Temporal Specifications	46
3.6	Closure Systems	53
<b>4</b>	<b>Universal Constructions</b>	<b>57</b>
4.1	Initial and Terminal Objects	58
4.2	Sums and Products	61
4.3	Pushouts and Pullbacks	67
4.4	Limits and Colimits	75
<b>5</b>	<b>Functors</b>	<b>83</b>
5.1	The Social Life of Categories	83
5.2	Universal Constructions Versus Functors	89

## Part II Advanced Topics

<b>6 Functor-Based Constructions.....</b>	<b>95</b>
6.1 Functor-Distinguished Kinds of Categories.....	95
6.2 Structured Objects and Morphisms.....	110
6.3 Functor-Structured Categories.....	117
6.4 The Grothendieck Construction.....	124
6.5 Institutions.....	128
<b>7 Adjunctions.....</b>	<b>141</b>
7.1 The Social Life of Functors.....	141
7.2 Reflective Functors.....	145
7.3 Adjunctions.....	151
7.4 Adjunctions in Institutions.....	160
7.5 Coordinated Categories.....	167
<b>Part III Applications</b>	
<b>8 Community.....</b>	<b>177</b>
8.1 A Language for Program Design.....	177
8.2 Interconnecting Designs.....	182
8.3 Refining Designs.....	191
<b>9 Architectural Description.....</b>	<b>197</b>
9.1 Motivation.....	197
9.2 Connectors in Community.....	199
9.3 Examples.....	204
9.4 An ADL-Independent Notion of Connector.....	211
9.5 Adding Abstraction to Connectors.....	214
<b>10 An Algebra of Connectors.....</b>	<b>221</b>
10.1 Three Operations on Connectors.....	223
10.2 Higher-Order Connectors.....	227
<b>References.....</b>	<b>237</b>
<b>Index.....</b>	<b>245</b>