

## Contents

	<i>Preface</i>	<i>page xi</i>
1	Introduction	1
	1.1 Introduction	1
	1.2 Background of Mixed Model Analysis	1
	1.3 General Approach	3
	1.4 Prior Knowledge	4
	1.5 Example Datasets	4
	1.6 Software	4
2	Basic Principles of Mixed Model Analysis	5
	2.1 Introduction	5
	2.2 Example	9
	2.3 Intraclass Correlation Coefficient	13
	2.4 Random Slopes	16
	2.5 Example	18
	2.6 Mixed Model Analysis with More than Two Levels	24
	2.7 Assumptions in Mixed Model Analysis	31
	2.8 Comments	32
3	What Is Gained by Using Mixed Model Analysis?	36
	3.1 Introduction	36
	3.2 Example with a Balanced Dataset	36
	3.3 Example with an Unbalanced Dataset	41
	3.4 Cluster Randomisation	43
	3.5 Comments	43

**viii**      **Contents**

4	Logistic Mixed Model Analysis	45
	4.1 Introduction	45
	4.2 Example	45
	4.3 Intraclass Correlation Coefficient in Logistic Mixed Model Analysis	51
	4.4 Different Estimation Procedures	52
	4.5 Other Ways to Adjust for the Correlated Observations	52
5	Mixed Model Analysis with Different Outcome Variables	58
	5.1 Introduction	58
	5.2 Categorical Outcome Variables	58
	5.3 Count Outcome Variables	65
	5.4 Survival Data	71
	5.5 Other Outcomes	77
6	Explaining Differences between Groups	78
	6.1 Introduction	78
	6.2 Example	79
7	Multivariable Modelling	90
	7.1 Introduction	90
	7.2 Prediction Models and Association Models	99
	7.3 Prediction and Validation	114
	7.4 Comments	115
8	Predictions Based on Mixed Model Analysis	116
	8.1 Introduction	116
	8.2 Shrinkage	116
	8.3 Different Possibilities to Obtain Predicted Values	121
	8.4 Comments	127
9	Mixed Model Analysis in Longitudinal Studies	131
	9.1 Introduction	131
	9.2 Longitudinal Studies	131
	9.3 Hybrid Models to Disentangle Between-Subject and Within-Subject Effects	139
	9.4 Growth Curve Analysis	141
	9.5 Other Methods to Analyse Longitudinal Data	147
	9.6 Comments	149

<b>ix</b>	<b>Contents</b>	
10	Multivariate Mixed Model Analysis	151
	10.1 Introduction	151
	10.2 Example	153
	10.3 Comments	163
11	Meta-Analysis on Individual Participant Data	166
	11.1 Introduction	166
	11.2 Example	167
	11.3 Comments	175
12	Sample-Size Calculations	179
	12.1 Introduction	179
	12.2 Standard Sample-Size Calculations	180
	12.3 Sample-Size Calculations for Mixed Model Studies	181
	12.4 Example	181
	12.5 Which Sample-Size Calculation Should Be Used?	182
	12.6 Comments	185
13	Some Loose Ends . . .	187
	13.1 The <i>xt</i> Procedures in STATA	187
	13.2 Hybrid Models Revisited	191
	13.3 Bayesian Mixed Model Analysis	195
	13.4 Software	204
	<i>References</i>	227
	<i>Index</i>	234