

CONTENTS

| | |
|--|-----------|
| Introduction | 1 |
| Basic symbols | 5 |
| 1 Basic regular linear model | 9 |
| 1.1 Locally best linear unbiased estimators | 13 |
| 1.2 Uniformly best linear unbiased estimators | 17 |
| 1.3 Locally minimum variance linear quadratic unbiased estimator | 21 |
| 1.4 Locally minimum variance linear quadratic unbiased invariant estimator | 33 |
| 1.5 Modified locally minimum variance quadratic estimator | 39 |
| 1.6 Uniformly minimum variance quadratic unbiased invariant estimator | 41 |
| 1.7 Minimum norm quadratic unbiased invariant estimator | 46 |
| 1.8 Statistical inference in the case of normality | 50 |
| 2 Basic regular linear model with constraints | 57 |
| 2.1 Indirectly measured complete vector parameter | 58 |
| 2.2 Indirectly measured incomplete vector parameter | 66 |
| 2.3 Examples of special cases of LM and LMC | 76 |

| | |
|--|------------|
| 3 Universal linear model | 85 |
| 3.1 Inference on the parameter of expectation | 85 |
| 3.1.1 Biased estimation | 93 |
| 3.2 Theorems on equivalence | 97 |
| 3.3 Hsu theorem and estimators of the unit dispersion | 111 |
| 3.4 Quadratic estimators of the variance components | 116 |
| 3.5 Universal linear model with constraints | 134 |
| 3.5.1 Estimation of the linear function of β | 134 |
| 3.6 Geometrical approach to linear models with constraints | 155 |
| 4 Models with nuisance parameters | 173 |
| 4.1 Analysis of structure | 174 |
| 4.2 Eliminating transformations optimum with respect to the first order parameters | 186 |
| 4.3 Eliminating transformations optimum with respect to the first and simultaneously to the second order parameters | 198 |
| 5 Asymptotical properties of estimators | 211 |
| 5.1 Consistency of the first order parameter estimators | 212 |
| 5.2 Asymptotical normality | 219 |
| 5.3 Consistency of quadratic estimators | 223 |
| 6 Sensitiveness and nonsensitiveness | 235 |
| 6.1 Sensitiveness and nonsensitiveness of the first order parameter estimates to the second order parameters | 235 |
| 6.2 Cleveland theorem | 251 |
| 6.3 Influence characteristics | 263 |

| | |
|---|------------|
| 7 Replicated linear models | 267 |
| 7.1 Simply replicated models | 267 |
| 7.2 Estimates of the second order parameter in mixed LM based on the Wishart matrix | 277 |
| 7.3 Exact and asymptotical confidence regions in replicated models | 295 |
| 7.4 A version of the Hsu theorem for a replicated LM | 316 |
| 8 Multistage linear models | 325 |
| 8.1 Twostage model | 326 |
| 8.2 Models with more than two stages | 341 |
| 8.3 Twostage model with constraints on parameters | 350 |
| 9 Multiepoch linear regression models | 365 |
| 9.1 Multiepoch linear regression models with stable and variable parameters | 368 |
| 9.2 Epoch models with variable parameters | 384 |
| 9.3 Processing data obtained by a group of devices – a compound model | 399 |
| 9.4 A combined replication of a linear mixed regression model . | 404 |
| 9.5 The locally best estimators of the useful first and second order parameters in an epoch model with nuisance parameters . . | 410 |
| 10 Appendix | 433 |
| 10.1 Some statements from matrix theory | 433 |
| 10.2 Some statements from probability theory | 446 |
| Bibliography | 455 |
| Index | 465 |