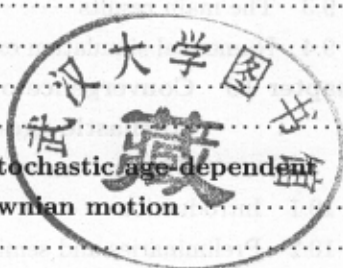


# Contents

《生物数学丛书》序

Preface

|                                                                                                                   |    |
|-------------------------------------------------------------------------------------------------------------------|----|
| <b>Chapter 1 Introduction</b>                                                                                     | 1  |
| 1.1 Introduction                                                                                                  | 1  |
| 1.2 Basic notations of probability theory                                                                         | 2  |
| 1.3 Stochastic processes                                                                                          | 9  |
| 1.4 Brownian motions                                                                                              | 15 |
| 1.5 Stochastic integrals                                                                                          | 18 |
| 1.6 Itô's formula                                                                                                 | 31 |
| 1.7 Moment inequalities                                                                                           | 40 |
| 1.8 Gronwall-type inequalities                                                                                    | 45 |
| <b>Chapter 2 Existence, uniqueness and exponential stability for stochastic age-dependent population</b>          | 48 |
| 2.1 Introduction                                                                                                  | 48 |
| 2.2 Assumptions and preliminaries                                                                                 | 49 |
| 2.3 Existence and uniqueness of solutions                                                                         | 52 |
| 2.3.1 Uniqueness of solutions                                                                                     | 52 |
| 2.3.2 Existence of strong solutions                                                                               | 53 |
| 2.4 Stability of strong solutions                                                                                 | 59 |
| <b>Chapter 3 Existence and uniqueness for stochastic age-structured population system with diffusion</b>          | 64 |
| 3.1 Introduction                                                                                                  | 64 |
| 3.2 Euler approximation and main result                                                                           | 66 |
| 3.3 Existence and uniqueness of solutions                                                                         | 68 |
| 3.3.1 Uniqueness of solutions                                                                                     | 68 |
| 3.3.2 Existence of strong solutions                                                                               | 70 |
| 3.4 Numerical simulation example                                                                                  | 76 |
| <b>Chapter 4 Existence and uniqueness for stochastic age-dependent population with fractional Brownian motion</b> | 79 |
| 4.1 Introduction                                                                                                  | 79 |
| 4.2 Preliminaries                                                                                                 | 81 |



|                                                                                                                                                          |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 4.3 Existence and uniqueness of solutions .....                                                                                                          | 84         |
| <b>Chapter 5 Convergence of the Euler scheme for stochastic functional<br/>partial differential equations .....</b>                                      | <b>90</b>  |
| 5.1 Introduction .....                                                                                                                                   | 90         |
| 5.2 Preliminaries and the Euler approximation .....                                                                                                      | 91         |
| 5.3 The main results .....                                                                                                                               | 93         |
| 5.4 Numerical simulation example .....                                                                                                                   | 99         |
| <b>Chapter 6 Numerical analysis for stochastic age-dependent<br/>population equations .....</b>                                                          | <b>101</b> |
| 6.1 Introduction .....                                                                                                                                   | 101        |
| 6.2 Preliminaries and the Euler approximation .....                                                                                                      | 102        |
| 6.3 The main results .....                                                                                                                               | 105        |
| <b>Chapter 7 Convergence of numerical solutions to stochastic<br/>age-structured population system with diffusion .....</b>                              | <b>116</b> |
| 7.1 Introduction .....                                                                                                                                   | 116        |
| 7.2 Preliminaries and approximation .....                                                                                                                | 118        |
| 7.3 The main results .....                                                                                                                               | 121        |
| 7.4 Numerical simulation example .....                                                                                                                   | 126        |
| <b>Chapter 8 Exponential stability of numerical solutions to a stochastic<br/>age-structured population system with diffusion .....</b>                  | <b>128</b> |
| 8.1 Introduction .....                                                                                                                                   | 128        |
| 8.2 Preliminaries and Euler approximation .....                                                                                                          | 130        |
| 8.3 The main results .....                                                                                                                               | 132        |
| 8.4 Numerical simulation example .....                                                                                                                   | 137        |
| <b>Chapter 9 Numerical analysis for stochastic age-dependent popula-<br/>tion equations with fractional Brownian motion .....</b>                        | <b>140</b> |
| 9.1 Introduction .....                                                                                                                                   | 140        |
| 9.2 Preliminaries and the Euler approximation .....                                                                                                      | 141        |
| 9.3 The main results .....                                                                                                                               | 144        |
| 9.4 Numerical simulation example .....                                                                                                                   | 154        |
| <b>Chapter 10 Convergence of the semi-implicit Euler method for<br/>stochastic age-dependent population equations with<br/>Markovian switching .....</b> | <b>156</b> |
| 10.1 Introduction .....                                                                                                                                  | 156        |
| 10.2 Preliminaries and semi-implicit approximation .....                                                                                                 | 157        |
| 10.3 Several lemmas .....                                                                                                                                | 159        |

|                                                                                                                                                       |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 10.4 Main results .....                                                                                                                               | 165        |
| <b>Chapter 11 Convergence of numerical solutions to stochastic age-dependent population equations with Poisson jump and Markovian switching .....</b> | <b>170</b> |
| 11.1 Introduction .....                                                                                                                               | 170        |
| 11.2 Preliminaries and semi-implicit approximation .....                                                                                              | 171        |
| 11.3 Several lemmas .....                                                                                                                             | 173        |
| 11.4 Main results .....                                                                                                                               | 179        |
| <b>Chapter 12 Numerical analysis for stochastic delay neural networks with Poisson jump .....</b>                                                     | <b>184</b> |
| 12.1 Introduction .....                                                                                                                               | 184        |
| 12.2 Preliminaries and the Euler approximation .....                                                                                                  | 185        |
| 12.3 The main results .....                                                                                                                           | 187        |
| 12.4 Numerical simulation example .....                                                                                                               | 195        |
| <b>Chapter 13 Convergence of numerical solutions to stochastic delay neural networks with Poisson jump and Markov switching .....</b>                 | <b>197</b> |
| 13.1 Introduction .....                                                                                                                               | 197        |
| 13.2 Preliminaries and the Euler approximation .....                                                                                                  | 198        |
| 13.3 Lemmas and corollaries .....                                                                                                                     | 201        |
| 13.4 Convergence with the local Lipschitz condition .....                                                                                             | 205        |
| <b>Chapter 14 Exponential stability of numerical solutions to a stochastic delay neural networks .....</b>                                            | <b>211</b> |
| 14.1 Introduction .....                                                                                                                               | 211        |
| 14.2 Preliminaries and approximation .....                                                                                                            | 212        |
| 14.3 Lemmas .....                                                                                                                                     | 214        |
| 14.4 Numerical simulation example .....                                                                                                               | 220        |
| <b>Bibliography .....</b>                                                                                                                             | <b>222</b> |
| <b>Index .....</b>                                                                                                                                    | <b>228</b> |