

Book: Theory and Multithreshold Decoding Algorithms

TABLE OF CONTENTS (The book will be published in Moscow in Russian, 2006)

| | |
|--|-----|
| The foreword of the scientific editor | 2 |
| From the author | 10 |
| Introduction | 17 |
| | |
| CHAPTER 1. THE CODING PROBLEM IN COMMUNICATION TECHNICS..... | 21 |
| 1.1. Linear codes..... | 21 |
| 1.2. The block and convolution codes unity..... | 26 |
| 1.3. The communication channels | 29 |
| 1.4. Multipositional signal systems | 33 |
| 1.5. Decoding algorithms for error correcting codes | 35 |
| 1.6. Decoding efficiency | 36 |
| 1.7. The code lengths | 43 |
| 1.8. The basic requirements for new algorithms | 44 |
| | |
| CHAPTER 2. THE PLAUSIBILITY GROWTH PRINCIPLE FOR THE MULTITHRESHOLD DECODER DECISIONS | 46 |
| 2.1. Efficiency and complexity: the research direction choice..... | 46 |
| 2.2. A principle of global functional optimization..... | 50 |
| 2.3. Algorithm of multithreshold decoding | 55 |
| 2.4. Gaussian channels | 66 |
| 2.5. Non-binary codes | 69 |
| 2.6. Decoding in channels with erasures | 76 |
| 2.7. Nonsystematic codes | 77 |
| 2.8. Multipositional systems of signals | 79 |
| 2.9. Data compression | 81 |
| 2.10. Application realm expansion of MTD principles | 84 |
| 2.11. Conclusions | 85 |
| | |
| CHAPTER 3. ERROR PROPAGATION OF MAJORITY DECODERS | 87 |
| 3.1. Concept of error propagation | 87 |
| 3.2. Error propagation in convolutional self-orthogonal codes | 89 |
| 3.3. Block self-orthogonal codes | 95 |
| 3.4. Integrated estimations of error propagation..... | 101 |
| 3.5. Grouping mistakes in uniform codes | 103 |
| 3.6. Non-binary codes | 110 |
| 3.7. Error grouping in the maximal length codes | 115 |
| 3.8. Decisions dependence in decoders for erasure channels | 117 |
| 3.9. Construction of codes with a small level of error propagation | 119 |
| 3.10. Conclusions | 122 |

| | |
|--|-----|
| CHAPTER 4. ANALYTICAL ESTIMATIONS OF MULTITHRESHOLD DECODING EFFICIENCY | 126 |
| 4.1. Methods of characteristics estimations | 126 |
| 4.2. Self-orthogonal codes | 129 |
| 4.3. Multithreshold procedures for non-binary codes | 136 |
| 4.4. The lower estimations of error probability for non-binary optimum decoders | 139 |
| 4.5. Characteristics of soft MTD algorithms | 142 |
| 4.6. MTD characteristics for channels with erasures..... | 143 |
| 4.7. Methods of improvement of the upper estimations for algorithm characteristics | 146 |
| 4.8. Bounds of effective majority methods usage..... | 147 |
| 4.9. Methods of MTD characteristics improvement | 152 |
| 4.10. Improvement of characteristics estimations for "soft" MTD | 154 |
| 4.11. Conclusions | 157 |
| | |
| CHAPTER 5. CHARACTERISTICS OF MULTITHRESHOLD ALGORITHMS | 158 |
| 5.1. Experimental methods of research | 158 |
| 5.2. Systems of imitating modeling | 159 |
| 5.3. MTD characteristics in the binary symmetric channel | 160 |
| 5.4. MTD characteristics in Gaussian channels | 162 |
| 5.5. High rate codes | 163 |
| 5.6. Nonbinary multithreshold decoders..... | 164 |
| 5.7. Decoding in erasing channels | 167 |
| 5.8. Compression of the data on base of MTD | 168 |
| 5.9. Complexity of soft realization | 169 |
| 5.10. Requirements to the coding equipment | 172 |
| 5.11. Characteristics of MTD decoders realized in PLIS | 175 |
| 5.12. Code gain of decoding algorithms | 176 |
| 5.13. Adaptability of MTD algorithms | 179 |
| 5.14. Parameters optimization of MTD decoders | 180 |
| 5.15. Conclusions | 181 |
| | |
| CHAPTER 6. MTD USAGE IN COMPLEX SYSTEMS | 183 |
| 6.1. Complex coding systems | 183 |
| 6.2. MTD Usage in concatenated circuits | 184 |
| 6.3. Concatenating for codes with parity checking | 187 |
| 6.4. Convolutional decoders for a concatenated code with parity checking..... | 189 |
| 6.5. MTD usage with multipositional modulation systems | 192 |
| 6.6. MTD usage for codes with unequal symbols protection | 194 |
| 6.7. Application of MTD in circuits of parallel coding..... | 196 |
| 6.8. Decoding codes with the detaled branches | 200 |
| 6.9. Characteristics of hardware coding | 209 |
| 6.10. Coding in channels with non-uniform power..... | 211 |
| 6.11. Application of MTD in channels with complex structure of error streams | 213 |
| 6.12. Conclusions | 214 |
| The conclusion | 217 |
| The summary (in English) | 227 |
| Appendices | 233 |
| The list of the reductions accepted in the book | 233 |
| The table of a level of noise in the Gaussian channel | 234 |
| Typical questions on coding | 236 |
| The list of the literature | 250 |
| Table of contents | 269 |