

## Content

PREFACE .....	9
INTRODUCTION.....	15
<b>Chapter1. High-performance methods of diagnostics and identification of the abnormal neurological state parameters caused by cognitive feedback influences of the cerebral cortex .....</b>	<b>21</b>
1.1 Problems of human neurological conditions.....	21
1.2 Comprehensive methodology and analysis tools for the diagnosis of neurological conditions of T-objects based on the hybrid ANM model. Problems of human neurological conditions .....	23
1.3 Hybrid mathematical model for the analysis of the ANM of the T-object based on feedback-connections and the effects of the neural nodes of the CC.....	26
1.4 Identification of ANM amplitude components. Inverse heterogeneous boundary value problem taking into account the cognitive feedback influences of the neuro-nodes of the CC.....	32
1.5 Initial-boundary value problems accompanying algorithms for identifying parameters in the ANM.....	35
1.6 Statement and methodology for the ANM conjugate boundary value problem solving .....	36
1.7 Statement and methodology for solving conjugate initial-boundary value problems of functional identification of the ANM .....	37
1.8 Expressions for gradient components and regularization expressions.....	39
1.9 Modeling and identification of parameters of complex multicomponent non-bio-feedback systems on multicore computers.....	42
<b>Chapter 2. High-performance methods of modeling and identification of feedback influences of competitive adsorption of gaseous air pollutants at micro- and macro-levels in nanoporous systems.....</b>	<b>50</b>



2.1. Analysis of research state .....	50
2.2 Experimental setup .....	52
2.3 Experimental results: Gaseous benzene and hexane competitive adsorption curves .....	52
2.4 A mathematical model of competitive adsorption and competitive diffusion in microporous solids .....	54
2.5 Numerical simulation and analysis: Competitive diffusion coefficients. Concentration profiles in inter- and intracrystallite spaces .....	62
2.6 Iterative gradient method of the identification of competitive diffusion coefficients .....	65
2.7 The linearization schema of the nonlinear competitive adsorption model. System of linearized problems and construction of solutions .....	69
<b>Chapter 3. High computational methods and simulation technology nanoporous systems with feedback adsorption for gas purification .....</b>	<b>76</b>
3.1 Nonlinear mathematical model of nonisothermal adsorption and desorption based on the generalized Langmuir adsorption equilibrium equation .....	77
3.2 The methodology for constructing analytical solution systems to heterogeneous adsorption / desorption problems .....	81
3.3 Computer simulation. Analysis of the distributions of the adsorbent concentration in the gas phase and nanopores of zeolite and temperatures .....	86
<b>Chapter 4. High-performance algorithms for solving systems of nonlinear equations on supercomputers with parallel organization of computations .....</b>	<b>92</b>
4.1 Layered parallel computing model .....	93
4.2 Parallel algorithms for solving SNE with a sparse data structure .....	97
4.3 Parallel algorithms for solving systems of linear equations with a sparse matrix .....	99



4.4 Hybrid algorithms for solving linear systems with sparse matrices of irregular structure based on LLT-decomposition of block-diagonal matrices with framing.. 125

4.5 Experimental study of parallel algorithms ..... 131

**Chapter 5. The methods of integral transformations for creation of hybrid ANM-models..... 137**

5.1. Finite integral Fourier transformation with spectral parameter for homogeneous media ..... 137

5.2 Finite hybrid integral Fourier transformation for bounded heterogeneous n-component media ..... 147

5.3 Integral Fourier transformation for semi-bounded heterogeneous n – component media ..... 169

**Conclusions ..... 187**

**References ..... 189**