

# Preface

This book examines the models of neural mediums described by a system of equations with delay. Each element of the medium (neuron) is the oscillator, which generates short pulses (spikes) in stand-alone mode. We discuss the models of synaptic interactions between neurons, which lead to complex oscillatory modes in the system. We study the structure of these modes and the ways of controlling their structure, that is, we solve the problem of choosing the weights of interaction to obtain attractors with predetermined structures. Such attractors are interpreted as images encoded in the form of autowaves (wave memory), thereby solving the problem of identifying attractors or image comparison. The system of equations defining the neural network is obtained from the biological premises, which include many parameters within the meaning of the task. The goal of the book is to develop methods for the asymptotic study of the neural system. These methods allow transfer to other types of equations.

This book discusses two physiological facts arising from theoretical studies: (1) the amount of short-term human memory correlates with the dimension (complexity) of electroencephalogram (EEG) signals; and (2) it is possible to identify visual stimuli on the evoked potentials (forced electric oscillations of the primary visual cortex). This book can be useful to both specialists in oscillatory neural networks as well as experts in differential equations. It is intended for senior students, graduate students, and young researchers engaged in oscillation theory.



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