Chapter 5
Models and Paradigms of Cellular Automata With a Variable Set of Active Cells

ABSTRACT

The chapter describes the functioning model of an asynchronous cellular automaton with a variable number of active cells. The rules for the formation of active cells with new active states are considered. Codes of active states for the von Neumann neighborhood are presented, and a technique for coding active states for other forms of neighborhoods is described. Several modes of operation of asynchronous cellular automata from the point of view of the influence of active cells are considered. The mode of coincidence of active cells and the mode of influence of neighboring active cells are considered, and the mode of influence of active cells of the surroundings is briefly considered. Algorithms of cell operation for all modes of the cellular automata are presented. Functional structures of cells and their CAD models are constructed.

INTRODUCTION

In the modern theory of CA, many dynamic processes are described and many of their models have already been built. Much attention is paid to the processes of the appearance of new objects and the disappearance of existing objects. Objects can be represented by a single cell or their combination. As

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a rule, such processes for each CA cell are determined by the state of the neighborhood cells, which can vary according to the given transition rules. The processes of interaction of several separate selected cells in the CA field are practically not described. For this interaction, the theoretical positions for ACA with active cells, described in previous chapters, were selected. Moreover, new paradigms allow the formation of new cells with new properties based on the existing properties of old cells that interact.

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MODEL AND ALGORITHMS FOR THE FUNCTIONING OF CELLULAR AUTOMATA WITH SEVERAL ACTIVE CELLS IN THE INFLUENCE MODE OF THE NEIGHBORHOOD CELLS

In the previous sections, ACA with one and several active cells was considered. In these ACAs, the number of active cells does not change. Also, they do not change LTF and LSF. It was shown that only active cells change their state at each time step or perform another LSF, which is different from the LSF that other inactive cells perform.

This chapter discusses the models and structures of ACA, which tend to change the number of active cells. In this case, ACA can use various algorithms for the formation and removal of active cells. This situation is partially considered in the work (Bilan, Bilan, & Bilan, 2017). Several examples of changes in the number of active cells are described.

In general, changes in active ACA cells can occur in two modes:

1. The mode of influence of the cells of the neighborhood;