Chapter 9
Models and Paradigms of Cellular Automata With an Organized Set of Active Cells

ABSTRACT

The chapter presents the principles of functioning of asynchronous cellular automata with a group of cells united in a colony. The rules of the formation of colonies of active cells and methods to move them along the field of a cellular automaton are considered. Each formed colony of active cells has a main cell that controls the movement of the entire colony. If several colonies of identical cells meet and combine, then the main cell is selected according to the priority, which is evaluated by the state of the cells of their neighborhoods. Colonies with different active cells can interact, destroying each other. The methods of interaction of colonies with different active states are described. An example of colony formation for solving the problem of describing contour images is presented. The image is described by moving the colony through the cells belonging to the image contour and fixing the cell sectors of the colony, which include the cells of the contour at each time step.

INTRODUCTION

In the previous chapters, CA models were considered, which described the evolution of CA during the interaction of individual active cells. In this case, models of the formation of cell colonies with active states were not

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considered. Not considered the interaction of groups of cells with the same and different active states. There is also a need to simulate the processes of formation of colonies and their decay, taking into account the behavior of various insects, animals and and people.

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BASIC THESES AND DEFINITIONS

In previous chapters, cellular automata were considered in which states changed with the help of active cells. ACA behaviors are described in which each active cell functions independently of other active cells. However, ACA structures are possible in which homogeneous groups of active cells (colonies of active cells) function. Homogeneous groups of active cells are characterized by the fact that they perform basic logical operations in interaction with other active cells. These cells can be neighboring (cells of a given shape of the neighborhood) and can be cells of the neighborhood of neighboring cells.

Interacting active cells can perform the same logical function, but can perform LSF, which depends on the performed LSF of neighboring active cells. A group of active cells is cells that are not isolated from each other. Cells of a group can interact with each other through other active cells of the same group. Examples of such groups of cells on Figure 1 are presented.

Figure 1 shows the groups of active cells that are highlighted in black. Each active cell of such a group can transmit active and informational signals to any other active cell of this group. These examples show that all active cells that make up the active groups have the same properties (have the same