Chapter 8
New Evolutionary Model of Life Based on Cellular Automata

ABSTRACT

The chapter presents software that implements models of asynchronous cellular automata with a variable set of active cells. The software is considering one of the modifications of the game Conway "Life". In the proposed model "New Life," the possibility of functioning of a separate "living" cell is realized, which, when meeting with other "living" cells, participates in the "birth" of new "living" cells with a different active state. Each active state is determined by a code that is formed by the state values of the cells of the neighborhood. Variants of the evolution of the universe based on the surroundings of von Neumann and Moore are considered. This program uses restrictions on the number of "born" cells in order to limit the overpopulation of the universe. Possible goals and objectives to be solved in the use of "New Life" are also considered.

INTRODUCTION

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CONWAY GAME OF "LIFE"

The English mathematician John Conway invented game of Life in 1970. On the basis of a cellular automata, a universe is presented in which there are two types of cells ("living" and "dead"). Dead cells are represented by a logical "1" state. Eight cells are used to realize the neighborhood (Moore neighborhood).

At the initial moment of the game of life is carried out by the initial filling of all CA cells with "living" and "dead" cells. That is, initially the corresponding cells are set to logical states "1" and "0". At each time step, a new generation is calculated. To do this, the following rules are used:

- If a cell has a logical "0" state ("dead" cell) and among neighboring cells three cells have a logical "1" state, the cell goes into a logical "1" state (life is born).
- If a cell has a state of logical "1" (a "living" cell) and among its neighboring cells there are two or three cells having a state of a logical "1" (("live" cells), then the cell remains in a state of logical "1" (continues live).
- If a cell has a logical "1" state (a "living" cell) and among its neighbors there are less than two or more than three cells that have a logical "1" state, then the cell goes into a logical "0" state ("dies").

The game is terminated according to the following rules.

- All cells go into a logical "0" state ("die").
- At one of the time steps, the state of the CA coincides with one of the states of the CA at the previous time steps.
- At the next time step, none of the CA cells changes their state.