

Chapter 2

Modeling of Dynamic Processes

ABSTRACT

The chapter describes the existing approach to modeling dynamic systems. The rules of the transfer of properties and conditions from cell to cell in cellular automata of various organizations are considered. The basic cell structures are presented in the transfer of only states, as well as properties of cell activity and states. The options are considered when the cell itself selects a cell among the cells in the neighborhood that will become active in the next time step. Also is considered is the option when the cell analyzes the state of neighboring cells and, based on the results of the local state function, makes a decision about the transition to the active state or not. An embodiment of a cell for transmitting an active state is described, only to cells with a given local logical function. Cell structures and their CAD models are constructed.

INTRODUCTION

Time is an integral characteristic of our life and all material objects on earth. Over time, all properties and shapes of objects change. Such a change is called a dynamic process. If nothing happens with the object and properties over time (their quantitative characteristics do not change), then the process is called static. However, in the modern world, static processes can be present only at short time intervals, which can be achieved by eliminating all external influences on the object. Depending on the stability of the object and the

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strength of external influences, all objects can change at different times, which indicates the presence of dynamic processes. In modern studies, dynamic processes are described by differential equations or systems of differential equations. However, they are not always suitable for describing the dynamics of the behavior of many objects. One of the solutions for describing the dynamics of the behavior of objects is the use of cellular automata.

The chapter describes the existing approach to modeling dynamic systems. The rules of the transfer of properties and conditions from cell to cell in cellular automata of various organizations are considered. The basic cell structures are presented in the transfer of only states, as well as properties of cell activity and states. The options are considered when the cell itself selects a cell among the cells in the neighborhood that will become active in the next time step. Also is considered is the option when the cell analyzes the state of neighboring cells and, based on the results of the local state function, makes a decision about the transition to the active state or not. An embodiment of a cell for transmitting an active state is described, only to cells with a given local logical function. Cell structures and their CAD models are constructed.

EXISTING APPROACHES TO MODELING DYNAMIC PROCESSES

Everything in the modern world is changing in space and time. The process of changing any properties of objects or processes in space and time is called a dynamic process. Various dynamic processes constantly occur in the world. The most understandable dynamic process for humans is the movement of an object. A moving object is precisely determined by a change in its location in space at various points in time.

However, the coordinates of objects do not change in space in many dynamic processes. In this case, other quantitative characteristics of the properties of the object may change or the properties of the object itself may change. New properties may appear or existing properties may disappear.

The dynamic process is characterized by two factors:

- the structure of the system of elements that forms the object and the initial states of the elements of the system;
- the interaction of several objects.

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