Mathematical Analysis in a Model of Primary Succession

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Abstract: This paper is concerned with a long-term ecological primary succession. The model of open Eigen's hypercycle has been used for modeling of the process. The multi-dimension case is analyzed. It is shown that consideration of system's dynamics can be simplified by partial reduction to the cases of lower dimension. The dynamics of ecological system can be considered as a self-organizing process with quasi-discrete characteristic. The quasi-discrete dynamics is explained by bifurcation properties of the system, that produce step-by-step changing of system's structure.

Keywords: *biogeocoenose; primary succession; stability; evolution; bifurcation; self-organization.*

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1 Introduction

Since the second half of the 20th century, illusion of happiness with regard to the development of a technocratic society disappears, while the number and severeness of the ecological crises increase. At this time researchers began to pay more attention to the study of ecological processes [2, 7, 17, 25, 26, 30].

The main object of the study is biogeocoenosis (as a collection of fauna and flora that exist in some area), and in particular a succession that takes place in it. In classical ecological theory there are two main types of succession: primary and secondary succession [26]. Note that a lot of works [5, 15, 19, 21, 28] are concerned with the mathematical modeling of the second type of ecological process. As to the first type, the works are mostly descriptive, of non-formalized character [12, 24, 27]. In this paper we examine the behavior of ecological systems during primary succession.

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