

I. DOROSHENKO

Yuriy Fedkovych Chernivtsi National University, Chernivtsi, Ukraine,
e-mail: *i.doroshenko@chnu.edu.ua*.

O. KNOPOV

V.M. Glushkov Institute of Cybernetics of NAS of Ukraine, Kyiv, Ukraine,
e-mail: *a.knopov@gmail.com*.

L. VOVK

National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute," Kyiv, Ukraine,
e-mail: *lilyvovk@gmail.com*.

MATHEMATICAL MODELS OF EXTREME MODES IN ECOLOGICAL SYSTEMS

Abstract. The authors consider the basic stages of creating a computer system for decision-making support in ecological security. The key factors of environmental pollution caused by ecological and technological catastrophes and typical failures in the operation of hazardous facilities are analyzed. Methods for quantitative estimation of the risk function are proposed. Ecological and mathematical models are created that make it possible to assess the current state of the environment, to make predictions, and provide a comprehension of the process under consideration.

Keywords: model, time series, trend, maximal likelihood method (MLM), least squares method (LSM), least modules method (LMM), minimax method (MMM).

Under condition of scientific and technical progress rapid development of the level of antropogenical and technical influence on the environment essentially increased. Thus, many biosphere parameters reached critical indices and so are becoming dangerous to human life and to the mankind existence in whole.

The problem arising in this connection make it necessary working out the system of decision making support in ecological security. This is one of the most difficult multi-factorial problems. Its decision is possible only with the use of system analysis methods.

Let's consider the basic stages of the creation of computer system of decision making support. The first stage consists in the analysis of basic factors of pollution after the ecological and technological catastrophes, typical failures of project, exploitation of dangerous objects and so on. The second stage involves the risk function quantitative estimation and creation of the ecological and mathematical model allowing to estimate current condition of nature and to give forecast for future. The main goal of the model design is to achieve the comprehension of the process under consideration.

Give an example taken from [1] dealing with the analysis of soils' main properties. Following [1], it's enough to consider such ones: 1) acids' neutralization; 2) adsorption of phosphorus and toxic materials; 3) oxygen donating.

Let us review each one.

1) **Acids' neutralization.** This capacity is substantial for maintaining the stability of fresh water habitats necessary for fish and other aquatic life protecting from acidity fluctuations. Soils' ability to neutralize acids essentially depends on their types.

Analyzing the situation over the last 100-150 years in the industrialized regions of North America and Europe the conclusion of the soils' buffering capacities large perturbations can be done. This is because of the great amount of sulfuric and nitric acidic rains resulting from burning of organic fuels. But the effect of such impacts is not uniform for different regions because of the large variability in soil type. [1] contains information about the acidification of lakes. The rate of lake response to acid inputs depends on two watershed soils fundamental qualities — the ability to retain sul-