



Possibilistic Modeling of Dynamic Uncertain Processes

O.S. Bychkov* and Ie.V. Ivanov

Taras Shevchenko National University of Kyiv, 64 Volodymyrska St., 01601 Kyiv, Ukraine

Received: June 30, 2010; Revised: July 15, 2013

Abstract: In the paper a new class of uncertain differential equations based on the possibility theory is introduced. It is argued that this class is well-suited for modeling uncertain dynamic processes when the uncertainty has a non-probabilistic nature, or when the available statistical information is not sufficient for constructing a reliable stochastic model. The problems of existence and uniqueness of solutions of the proposed equations are studied and a numerical method for their solution is provided.

Keywords: *possibility theory; dynamical system; possibilistic walk process; Cauchy problem.*

Mathematics Subject Classification (2010): 34A07, 34A12.

1 Introduction

The methods of (quantitative) possibility theory [7, 10, 11, 20] allow one to estimate the level of possibility of some event with respect to possibilities of other events on the basis of subjective opinions of experts. These methods are useful for reasoning about uncertain processes and phenomena in cases when the lack of statistical information does not allow one to apply probabilistic methods, or when uncertainty has a non-probabilistic nature. The applications such as prognostication of social-economic phenomena, medical diagnostics, modeling of human-machine systems, etc. often require differential equations with uncertainty in the structure and/or parameters. However, in these applications the available statistical information is often rather limited or unreliable (because of absence of repetitions of the studied phenomena under the same conditions). Therefore, it is reasonable to apply non-probabilistic uncertainty theories (e.g. possibility theory) in such cases [4, 20].

* Corresponding author: <mailto:bos.knu@gmail.com>