



ELSEVIER

Physica A 303 (2002) 427–438

PHYSICA A

www.elsevier.com/locate/physa

Intensity approximation of random fluctuation in complex systems

R.M. Yulmetyev*, F.M. Gafarov, D.G. Yulmetyeva,
N.A. Emeljanova

*Department of Theoretical Physics, Kazan State Pedagogical University, Mezhlauk Street 1,
420021 Kazan, Russia*

Received 22 March 2001; received in revised form 6 June 2001

Abstract

The Markov and non-Markov processes in complex systems are examined with the help of dynamical information Shannon entropy method. Here we consider the essential role of two mutually independent channels of entropy involving creation of correlation and annihilation of correlation. The developed method has been used to analyze the intensity fluctuation of the complex systems of various nature: in psychology (to analyze numerical and pattern short-time human memory, to study the effect of stress on the parameters of the dynamical tapping-test) and in cardiology (to analyze the random dynamics of RR-intervals in human ECG's and to diagnose various diseases of human cardiovascular systems). The received results show that the application of intensity approximation allows to improve essentially the diagnostics of parameters in the evolution of human dynamic states. © 2002 Elsevier Science B.V. All rights reserved.

PACS: 05.40.+j; 05.60.+w

Keywords: Intensity fluctuation; Complex systems; Nonlinear phenomena;
Markov and non-Markov processes; Dynamical information Shannon entropy;
Application in psychology and cardiology

1. Introduction

Recently the interest towards such important properties of complex systems as their sensitivity [1,2] to weak disturbances and their relation with information concepts, including the Shannon and Renyi entropy, Kolmogorov–Sinai entropy rate [3–11] has

* Corresponding author. Tel.: +7-8432-92-5373; fax: +7-8432-32-4269.

E-mail addresses: rmy@ntp.ksu.ras.ru (R.M. Yulmetyev), gfm@ntp.ksu.ras.ru (F.M. Gafarov).