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Universal distribution function for the strongly-correlated fluctuations: General way for description of different random sequences

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ABSTRACT

It has been proved that for the strongly-correlated fluctuations there is a universal distribution function for the relative fluctuations (UDFRF). The analytical form of this function follows from the solution of some types of the functional equations. For obtaining the UDFRF a procedure of the optimal linear smoothing (POLS) has been developed. This procedure based on criterion of the minimal relative error helps to separate correctly a possible trend (the "low-frequency" curve, defined as the *generalized mean value* curve or trend) from the "high-frequency" (HF) fluctuations, defined as a random sequence of *relative fluctuations* with zero trend. A universal treatment procedure outlined in this paper helps to find an *optimal* trend, separate it from the relative HF fluctuations and read them *quantitatively*. The statistics of the fractional moments outlined in this paper helps "to read" the found trends and express them in terms of the fitting parameters if the model for their description is *absent*. These new possibilities can be applied for description of different noises (quantum fluctuations, for example) that always present on the scale ($10^{-6} \div 10^{-9}$ m). Quantitative reading of these noises with their subsequent classification is important for every developing nanotechnology that it has a possibility to be applied in this range of scales.

1. Introduction

In analysis of any random sequence we have three different types of errors:

1. The measurement errors related to equipment used.
2. The uncontrollable errors related to the model (physical, mathematical) chosen.
3. The uncontrollable errors related to treatment procedure.

The basic question can be formulated as follows.

Is it possible to eliminate the errors related to points 2 and 3? Recent investigations of the author of this paper show that answer can be definitely *positive*.

The author of this paper suggests the unique (not having similar analogies) methods related to a quantitative "reading" of an arbitrary random sequence having different (technical, geological, economical, medical, and etc.) origin. These suggested methods have the following remarkable properties:

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