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NAFASS in action: How to control randomness?

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ABSTRACT

In this paper the original method of transformation of one random function to another one is suggested. The problem of transformation of one random function to another one is based on the NAFASS approach suggested previously by one of the authors (RRN) in paper [1]. The problem can be formulated as follows: is it possible to transform one random function to another one (the functional forms of the both functions are *not* known) during the fixed segment of time t_1? The solution of this problem shown in this paper gives a chance to manage with random functions that describe many complex systems, where the adequate model pretending on their functional or analytical description is *not* known. This transformation based on the successful solution of the Prony's problem gives unique chances to manage with some chemical processes, technological processes and understand better the general behavior of the different complex systems which cannot be managed by the human being. Besides this solution another solution of this problem related to control of detrended random sequences is considered also.

1. Formulation of the problem

The general problem that we are going to solve in this paper can be formulated as follows. From the mathematical point of view it is necessary to find a transformation of one random function to another during the given interval of time $\tau \in [t_0, t_1]$. It is supposed that these random functions can be presented only in the form of digital data base and neither their analytical forms nor the corresponding differential equations are *not* known. Schematically, it can be expressed in the following form

$$P_0(t+\tau) = Tr(\tau)P_1(t) \tag{1}$$

Here $Tr(\tau)$ defines a transformation operator. In order to understand better the practical solution of this problem let us consider some important details. We suppose that there is a set of control variables v_q ($q = 1,2,\ldots,Q$) that control the output $P_0(t)$. These variables making an influence on the output $P_0(t)$ are independent and uncorrelated (or weakly correlated) with each other. If the control variables are strongly correlated then a subset of the strongly-correlated variables should be reorganized and new set of the uncorrelated variables can be formed again. In this case one can write mathematically two limiting possibilities

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