http://www.moderntechno.de/index.php/meit/article/view/meit40-02-018
DOI: 10.30890/2567-5273.2025-40-02-018

UDC 342.3

MATHEMATICAL MODELING OF HUMAN LIFE: RANDOM NUMBERS AND FRACTALS

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Abstract. *This paper attempts to describe human life using mathematical modeling tools. It offers an approximate mathematical model that schematically describes and characterizes life through core, mutually exclusive philosophical, psychological, and existential concepts: happiness–unhappiness, good – evil, love–hate.*

In this work, the following basic principles and hypotheses are presented: human life consists of interconnected opposites: happiness and unhappiness, love and hate, positive and negative; positive and negative periods alternate; the total sum of all positives and negatives over a person's life equals zero. Before the birth and after the death of a person, the graph of the function, which is a mathematical model, exhibits no fluctuations, continuing instead as a straight line.

These hypotheses enable approximate modeling of human life. For example, purposely reducing the duration and amplitude of "positive" experiences (within the model) also reduces the quantity of "negative" ones.

Such concepts are found in many philosophical and religious doctrines, including asceticism. Apparently, asceticism is a philosophical and spiritual practice that is characterized by a voluntary rejection of pleasures and enjoyments in order to achieve a moral or religious ideal, self-improvement, or spiritual enlightenment. It involves self-restraint, moderation, and the rejection of excess in the fulfillment of one's needs and desires.

This article assumes the amplitude and frequency of life's fluctuations are random, ranging from zero to one.

It also proposes that the main characteristic features of the mathematical model repeat with precise accuracy at various stages of life: day, week, month, year, a few years (ex. seven years), etc. This aligns with fractal theory, and, therefore, the results of this theory can be applicable in further studies of this topic.

Keywords*: mathematical modeling of human life, random numbers, fractals.*

Introduction.

Modeling of human life, particularly mathematical modeling of human life, is currently an important yet underexplored topic in scientific research. Methods of mathematical modeling are widely used across various areas of human activity, especially in forecasting and management. Such methods are extensively applied in natural sciences. However, the use of mathematics in social and humanitarian fields is extremely limited. This can be explained by the ambiguous nature of the phenomena

being studied. In this work, we acknowledge that it is likely impossible to create a model that accurately describes human life — a task that has intrigued generations of scientists.

In this study, a mathematical model is proposed that can approximately describe human life from the perspective of how life itself is perceived. It is assumed that the amplitude and frequency of the oscillations in the mathematical model are random. It is also assumed that the main hypotheses for constructing a mathematical model of human life, as presented in work [1], can be applied to various intervals (stages) of life: a day, a week, a month, a year, several years. We assume that the main features of the mathematical model from [1] are repeated with a certain degree of accuracy at each of these intervals. This fact aligns with the basic principles of fractal theory and, therefore, the results of this theory can be applied in further research related to this topic.

Main Text.

In work [1], it is assumed that human life consists of opposing yet interconnected concepts: happiness and unhappiness, love and hate, positive and negative, and so on. Six hypotheses were proposed in [1], including the following: positive and negative periods alternate; the amplitude and frequency of oscillations can take various values starting from zero; the total area bounded by the given curve and the Ox axis equals zero; before birth and after death, the graph of the function has no oscillations but continues as a straight-line coinciding with the Ox.

It is evident that precisely determining the mathematical model (the behavior of each component function included in the model) is impossible. In our view, we can only approximate a description of such a model.

In work [2], the predictors of subjective well-being (happiness) are studied using elements of regression analysis.

In work [1], a mathematical model of human life was constructed, which includes a periodic function, a fluctuation amplitude function, and a log-normal distribution function.

In this study, it is proposed to consider the amplitude function and the frequency function as random numbers that, over certain time intervals, independently take on

random values within the range from zero to one. To implement this, a random number generator can be used.

Let's suppose, for example, that we want to approximately model, describe (or predict) a human life of duration T. We divide this interval into N equal parts. We denote:

$$\pi n - \pi \le t \le \pi n, \quad n = 1, 2, \dots, N, \quad T = \pi N,$$

where N - is an even number.

Then, on each interval $\pi n - \pi \le t \le \pi n, \quad n = 1, 2, \dots, N$ we will assume that the amplitude and frequency take on random values (random numbers) between zero and one: $A_n = A(t), \ \omega_n = \omega(t)$.

Then the function that serves as a mathematical model according to [1] will have the form:

$$f_n = y(t) A_n \sin(\omega_n t), \quad \pi n - \pi \le t \le \pi n, \quad n = 1, 2, \dots, N. \qquad (1)$$

Here, the function $y(t)$ represents the log-normal distribution [1].

The area of the figure bounded by the graph of function (1) and the Ox axis for each interval will be: $\pi n - \pi \le t \le \pi n, \quad n = 1, 2, \dots, N$ will be:

$$S_n = \int_{\pi n - \pi}^{\pi n} y(t) A_n \sin(\omega_n t) dt, \qquad \pi n - \pi \le t \le \pi n, \quad n = 1, 2, \dots, N.$$

Then, taking into account the fact that the areas S_n depending on n alternately take on different signs (but finite values), positive or negative, in accordance with Hypothesis 4 [1], it can be stated that:

$$\sum_{n=1}^{N} S_n(x) \approx 0.$$

Therefore, hypothesis 4 [1] is approximately satisfied.

Or, if we move to the limit:

$$\lim_{N \to \infty} \frac{\sum_{n=1}^{N} S_n(x)}{N} = 0.$$

The work also assumes that the main hypotheses for constructing a mathematical

model of human life, as outlined in [1], can be applied to various intervals (stages) of a person's life. We divide a person's entire life into different intervals, starting from the smallest — one day, and ending with the largest — the person's whole life. These intervals may include, for example: one day, a week, a month, a year, several years (such as seven), and so on. For example, let's consider a one-day interval. Starting from the moment of waking up, the amplitude and frequency of the function's oscillations are close to zero. Then, gradually, a person begins to experience short periods of both positive and negative emotions with small amplitude and frequency, alternating with each other. At a certain point during the day, this process reaches its peak and then gradually diminishes by evening.

It is assumed that the main features of the mathematical model, as presented in the form of hypotheses in [1], are approximately repeated at each of these stages (intervals). This fact corresponds to the main principles of fractal theory. Therefore, the results of this theory can be applied in further research related to this topic.

As is known, fractals in mathematics are objects composed of parts that exhibit self-similarity, meaning they resemble the whole at different scales. They are often characterized by recursion and are formed, for example, as a result of iterative processes—in example, creating new elements based on previous ones.

The main types of fractals include: geometric fractals, algebraic fractals, and stochastic fractals, which are generated using random numbers.

Conclusions.

This work examined the application of mathematical modeling for the approximate description (prediction) of human life. The study is based on hypotheses proposed in [1], namely: 1) human life consists of opposing yet interconnected concepts: happiness and unhappiness, love and hate, positive and negative; 2) positive and negative periods alternate with each other (Hypothesis 1, [1]); 3) the total sum of all positive and negative experiences throughout a person's life equals zero (Hypothesis 4, [1]); 4) before birth and after death, the graph of the function representing the mathematical model has no oscillations but continues as a straight line (Hypothesis 6, [1]).

In this article, it is assumed that the amplitude and frequency of oscillations in the model are random in nature, with their numerical values ranging from zero to one.

It is also assumed that the main hypotheses regarding the construction of a mathematical model of human life, as set out in [1], can be applied to different intervals (stages) of a person's life. These intervals may include, for example: a day, a week, a month, a year, several years (for example seven), and so on. It is assumed that the key characteristics of the mathematical model [1] are approximately repeated at each of these stages (intervals). This fact aligns with the core principles of fractal theory, and therefore, the results of this theory can be applied in future research on this topic.

In work [1], six hypotheses were proposed. We would like to particularly highlight the fourth one: the total area between the given curve and the Ox axis equals zero. In other words, the total amount of "positive" and "negative" throughout a person's life is *the same*.

This hypothesis allows for an approximate, schematic modeling and forecasting of human life. For example, if one consciously reduces the period and amplitude of "positive" experiences, then—according to this model—the amount of "negative" also decreases.

Such approaches can be found in many philosophical and religious teachings from China, India, and elsewhere. For example, let's consider asceticism. As is known, asceticism is a philosophical and spiritual practice characterized by the voluntary renunciation of worldly pleasures and comforts in order to attain a moral or religious ideal, self-improvement, or spiritual enlightenment. It involves self-restraint, moderation, and rejection of excess in the satisfaction of physical needs and desires. At the heart of asceticism lies the belief that through self-limitation and denial of worldly pleasures, one can achieve a higher level of consciousness, be freed from suffering, and attain spiritual growth.

Let us also consider, for example, the core principles of Buddhism, analyzing them within the framework of our model:

1. Life is inevitably connected with suffering. (Model: the graph of the function must necessarily include negative intervals or periods — hypothesis 1, [1]).

2. The cause of suffering is the craving for existence and sensual pleasures. (Model: the presence of “negative” periods is caused by the presence of “positive” ones — hypothesis 4, [1]).

3. To avoid suffering, one must free oneself from this craving for existence and attain complete tranquility — nirvana. (Model: by reducing the “positive” part, the “negative” part is also automatically reduced — hypothesis 4, [1]. Complete tranquility in the model corresponds to motion without oscillations or amplitude — hypothesis 6, [1]).

4. There is a path to the cessation of craving, and thus suffering. (Model: motion without oscillations and amplitude — hypothesis 6, [1]).

The goal of future research could be to determine (approximately, theoretically, or experimentally) the behavior of the functions used in model (1). To achieve this, it is proposed to involve specialists from fields such as psychology, sociology, biology, philosophy, and others.

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The article was prepared as part of the research project “Mathematical methods and models in applied economic research” (0123U101895)

Article sent:07.08.2025