Discrete Dynamics of State Parameters of Fractal Thermodynamics of Covid19 Pandemics

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Abstract. ***Background:*** Currently, one of the urgent tasks of mathematical modeling is the construction of mathematical models that adequately describe pandemics, in particular, the Covid-19 pandemic. In recent few years, many studies have been devoted to solving this problem, using various methods and approaches. Purpose: The paper reveals the characteristic features of the discrete dynamics of state parameters in the fractal thermodynamics of Covid-19 pandemic from 01/22/2020 to 09/21/2022. These features are shown to be useful for forecasting discrete dynamics of pandemics and analogous processes.

Methods: In recent few years, many studies have been devoted to solving this problem, using various methods and approaches. In most of these studies, the raw data is the number of daily diseases $\nu(t)$ determined from the approved statistical data. A fundamentally new approach to the study of $\nu(t)$ is implies the use of fractal and multifractal analysis.

Results: If we approximate the set of all states (S_{f_i}, T_{f_i}) by fractal state equations $S_f = A T_f^\gamma$, then this set turns out to divide into subsets, each most close to a certain fractal equation of state, determined by parameter γ and A. This gives rise to a discrete dynamics of fractal phase states, determined by the jumps in the parameters γ and A. A passage to the limit yields the following asymptotic fractal equation of state: $S_f = 12.143 T_f^{0.0147}$. It is shown that the jumps in the parameters A, γ lead to fractal phase transitions between fractal phase states of Covid-19 pandemics. An analytic continuation to the forecast period yields the values of forecast coefficients $A_{IV} = 11.7580, \gamma_{IV} = 0.01475$.

Conclusions: In this paper the characteristic features of the discrete dynamics of the fractal thermodynamic state parameters of the Covid-19 pandemic from 01/22/2020 to 09/21/2022 are revealed. It is shown that these features can be used to predict the discrete dynamics of pandemics and other similar processes.

Keywords: mathematical model, fractal thermodynamics, Covid-19 pandemic, dominating variant of Covid-19, discrete dynamics

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