THE CONTINUOUS WAVELET TRANSFORM AS A TOOLS FOR BIFURCATION ANALYSIS OF DYNAMICAL SYSTEMS. CASE STUDY: OSCILLATIONS OF TRANSMEMBRANE POTENTIAL IN CHARA CORALLINA

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Nowadays, the Continuous Wavelet Transform is one of most powerful methods for an analysis of non-stationary signals. It has a lot of applications due to the opportunity to study a local spectrum of the time series generated by dynamical systems.

Recently [1] a novel method for evaluation of the CWT with the Morlet wavelet based on the reduction this integral transform to the solution of the partial differential equations has being proposed.

This work presents further development of this approach from the side of a numerical realization and application to the analysis of biophysical dynamical systems. Namely, the computer implementations using Ros43 Hairer-Wanner, RK21 Hoeven, RK43 Bogacki-Shampine, RK54 Dormand-Prince solving algorithms is considered. It has been shown that they have sufficient advantages over standard methods of CWT calculations (the usage of FFT and filters). Corresponding developed software will be presented.

As an example, we consider the analysis of chaotic oscillations observed in the mathematical model describing the dynamics of transmembrane potential and changes of proton concentration outside the cell of alga Chara corallinà [2]. We show that this mathematical approach provides an accurate and fast processing of large data massive, which allows to make more clear details of this mathematical model's complex dynamics.

References.

1. *Postnikov E.B.* Evaluation of a Continuous Wavelet Transform by Solving the Cauchy Problem for a System of Partial Differential Equations// *Comp. Math. Math. Phys.* **46**, 2006. Pp. 73-78.
2. *Plyusnina, T.Yu., Lavrova A.I., Price C.B. et al.* Nonlinear Dynamics Near the Cell Membrane of Chara Corallina // *J. Biol. Syst.* **16**, 2008. Pp. 197-218.