

## SYSTEMS WITH MEMORY, NONLOCALITY AND ANTICIPATION. SOME NEW EXAMPLES AND NEW RESEARCH PROBLEMS

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Recently some new solutions have been found for distributed media : dynamical chaos, oscillations, autowaves, synchronization and quite recently “chimera” states. Till now mostly the classical parabolic equations (or related with them) have been used. But now it was recognised that more accurate equations should be used (see for example [1]. Here we describe some possibilities for posing new research problems. First of all we consider the models with memory (relaxation). In such case one of the classes of models constitute the infinite systems of o.d.e of second order in time received by projection methods. Such systems remember the systems of coupled oscillators. So the problems of energy transitions on spectrum receives new solutions (from large to small scales). At second, we consider quasilinear hyperbolic Burgers equation of second order in time [1]. However, it is not enough studied. There are examples of the new solutions in the report. Fractal theory is one of the most flourishing mathematic modeling directions which find its application in the use of new and new fields of technology and basic research, including cellular automata theory, pattern recognition, artificial intelligence etc. One of the most important its question is a determination and an estimation for fractal dimensions of such fractal sets. Here we consider the attractors of dynamic systems with multi-valued evolution operators. We have gotten an upper estimation for Hausdorff dimension of the attractors of such kind of systems. The basic example is the logistic (Ferhulst) equation with the anticipatory property. Finally, the new possibilities supply the accounting of nonlocality. This follows to presumable origin of new “chimera” states in hydrodynamics. In addition, accounting of anticipation follows to the possibilities of multivalued “chimera” states.

## References

- [1] V. A. Danylenko, T. B. Danevych, O. S. Makarenko, S. I. Skurativskiy, V. A. Vladimirov, *Self-organization in nonlocal non-equilibrium media*. Subbotin in-t of geophysics NASU, Kyiv, (2011).