

On optimality condition of complex systems

VICTOR KOROTKIKH AND GALINA KOROTKIKH

*Faculty of Informatics and Communication, Central Queensland University,
Mackay, 4740, Queensland, Australia* [v.korotkikh@cqu.edu.au
g.korotkikh@cqu.edu.au]

The efficient management of complex systems is becoming increasingly important. However, despite significant progress and interest in complex systems, there is a limited understanding of the problem. In particular, because the existence of principles governing the non-equilibrium situation has not yet been established [1], the possibility of a general condition determining the optimal performance of a complex system is still unknown.

To contribute in this direction, an optimization algorithm as a complex system is presented. The performance of the algorithm for any problem is controlled as a convex function with a single optimum. To characterize the performance optimums, certain quantities of the algorithm and the problem are suggested and interpreted as their complexities [2]. An optimality condition of the algorithm is computationally found: *if the algorithm shows its best performance for a problem, then the complexity of the algorithm is in a linear relationship with the complexity of the problem.*

The optimality condition provides a new perspective to the subject by recognizing that the relationship between certain quantities of the complex system and the problem may determine the optimal performance.

1. BALL, P. (1999). Transitions still to be made. *Nature* **402**, 73–76.
2. KOROTKIKH, V. (1999). *A mathematical structure for emergent computation*. Kluwer, Dordrecht.