Synchronization of Automata

Mikhail V. Berlinkov

Institute of Mathematics and Computer Science, Ural Federal University,
620000 Ekaterinburg, Russia
berlm@mail.ru

Synchronizing automata serve as transparent and natural models of error-resistant systems in many applications (coding theory, robotics, dna-computing, testing of reactive systems) and also reveal interesting connections with symbolic dynamics and other parts of mathematics.

We consider the basic issues of synchronization in the classical case of complete deterministic automata. Given a finite automaton, any word is called *reset* if it takes the automaton in a one particular state no matter of the original one. If an automaton possesses such words it is called *synchronizing* and the minimum length of the reset words is called its *reset threshold*.

As an example of such issues we consider the famous Černý conjecture which states that the reset threshold of synchronizing automaton with n states cannot exceed $(n-1)^2$ (Černý, 1964). Despite the number of attempts to attack this conjecture, it remains open for 50 years in the general case and the best upper bound is only cubic $\frac{n^3-n}{6}$ (Pin, 1983). We also overview the state of the art in other important aspects of synchronization, such as, computational complexity of testing for synchronization and computing reset thresholds, synchronization of random automata and others.