The Synchronization Problem for Strongly Transitive Automata

Flavio D'Alessandro
Università di Roma
dalessan@mat.uniroma1.it

The *synchronization problem* for a deterministic n-state automaton consists in the search of an input-sequence, called a *synchronizing word* such that the state attained by the automaton, when this sequence is read, does not depend on the initial state of the automaton itself. If such a sequence exists, the automaton is called *synchronizing.* If the automaton is deterministic and complete, a well-known conjecture by Cerny claims that it has a synchronizing word of length not larger than $(n-1)^2$ [1]. This conjecture has been shown to be true for several classes of automata. Two results deserve a special mention: in [3], Kari proved Cerny conjecture for automata whose underlying graph is Eulerian. Dubuc [2] proved the conjecture for circular automata, that is, for automata possessing a letter that acts, as a circular permutation, over the set of states of the automaton. Recently, Béal proposed an unified algebraic approach that allows one to obtain quadratic bounds for the minimal length of a synchronizing word of circular or Eulerian automata. By developing this theoretical approach, we study the synchronization problem for a new class of automata called *strongly transitive.* A n-state automaton is said to be strongly transitive if it is equipped by a set of words $\{w_1, ..., w_n\}$, called *independent*, such that, for any pair of states s and t, there exists a word w_i such that $sw_i = t$. An extension to unambiguous automata is also considered.

1. J. Cerny, Poznámka k. homogénnym experimenton s konecnými automatmi, *Mat. fyz. cas SAV,* 14, 208–215, 1964.

2. L. Dubuc, Sur les automates circulaires et la conjecture de Cerny, *RAIRO Inform. Théor. Appl.,* 32, 21–34, 1998.

3. J. Kari, Synchronizing finite automata on Eulerian digraphs, *Theoret. comput. sci.,* 295, 223–232, 2003.

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