Self-Regulating Automata

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In formal language theory, the choice of a transition rule of a finite automaton depends only on the current state and input symbol. To gain greater control over the choice of transition rules, regulated automata have been introduced. In our presentation we discuss a special type of regulated automata, called self-regulating automata. In short, these automata, based on traditional finite and pushdown automata, regulate the set of moves they can take from a particular configuration based on moves they have taken previously. We discuss two types of self-regulating automata – self-regulating finite automata (SFA), and self-regulating pushdown automata (SPDA).

The first part of our presentation is devoted to self-regulating finite automata. Depending on how their self-regulation is defined, we distinguish between n-turn first-move self-regulating automata and n-turn all-move self-regulating finite automata. We show the relation between the languages defined by these types of automata, and the languages generated by n-parallel right-linear grammars and n-right linear simple matrix grammars, respectively. Both of these types of automata establish an infinite hierarchy of language families lying between the families of regular and context-sensitive languages.

In the second part we deal with self-regulating pushdown automata. Analogously to the case of self-regulating finite automata, we distinguish between n-turn first-move and n-turn all-move self-regulating pushdown automata. We discuss the families of languages defined by n-turn all-move self-regulating pushdown automata, showing that 1-turn all-move self regulating pushdown automata are powerful enough to describe the family of recursively enumerated languages. Finally, we mention some open problems concerning self-regulating pushdown automata.