Self-Regulating Automata

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In practice, it is usually required for a computation to follow some specified rules and satisfy given constraints. In the formal language theory, such computation is formalized by introducing regulated grammars. In VYPa course we have already encountered a specific kind of such grammars, namely, grammars with control language, where a selection of a rewriting rule is driven by this control language. We have also discussed their automata-based counterparts - automata regulated by control languages - in which the control language specifies a transition to be performed.

In our presentation, we discuss yet another kind of regulated automata, namely, self-regulating automata. As opposed to automata regulated by control languages, self-regulating automata coordinate a selection of a transition rule by establishing a relation between consecutive transitions. In the first part of our talk we discuss self-regulating finite automata (SFA), in particular, n-turns first-move SFAs, and explain the basic mechanism behind rule choice regulation. We briefly draw the connection between n-turns first-move SFAs and n-parallel right-linear grammars, discuss the accepting power of these automata as well as their closure properties. Then, we generalize these automata by introducing n-turns all-move SFAs, compare them with n-right linear simple matrix grammars, as well as examine their properties. Finally, we carry out the argument into the realm of pushdown automata by introducing n-turns first-move and n-turns all-move self-regulating pushdown automata (SPDA), discuss their features and mention selected open problems associated with them.