Klíma, Ondřej; Polák, Libor

The positive polynomial operator \( \text{PPol} \) assigns to each positive variety of languages \( V \) the class of all finite unions of finite intersections of the languages of the form

\[ L_0a_1L_1 \ldots a_lL_l \]  

where \( A \) is an alphabet, \( a_1, \ldots, a_l \in A, \ L_1, \ldots, L_l \in V(A) \). Using Boolean combinations we get the polynomial operator \( \text{BPol} \). Such operators on classes of languages lead to several concatenation hierarchies. Well known cases are the Straubing-Thérien hierarchy and the group hierarchy (see Chapter 10 “Syntactic semigroups” by J.-E. Pin in [G. Rozenberg (ed.) and A. Salomaa (ed.), Handbook of formal languages. Berlin: Springer (1997; Zbl 0866.68057)]. The authors study four hierarchies of languages which result from considering finite unions of finite intersections or Boolean combinations of languages (*) over the positive variety \( V \), such that the set \( V(A) \) is equal either to finite unions of \( B^* \), where \( B \subseteq A \), or finite unions of \( B \), where \( B \subseteq A \) and \( B \) is the set of all words over \( A \) containing exactly the letters from \( B \). Members of all these hierarchies are under the second level in the Straubing-Thérien hierarchy. Basic questions are to explore inclusions among these varieties of languages and the existence of finite bases for corresponding pseudovarieties of (ordered) monoids. This paper essentially makes use of the material of the recent paper by the same authors [Lect. Notes Comput. Sci. 5725, 260–277 (2009; Zbl 1256.68124)]

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MSC:

68Q70 Algebraic theory of languages and automata
20M35 Semigroups in automata theory, linguistics, etc.
68Q15 Complexity classes (hierarchies, relations among complexity classes, etc.)
20M07 Varieties and pseudovarieties of semigroups

Keywords:
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[6] DOI: 10.1007/978-3-642-59136-5_10 · doi:10.1007/978-3-642-59136-5_10

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