On Exactly Controlled Grammars

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Abstract. Exactly controlled grammars [1] are grammars extended with a control set, with the condition that the control set is exact, in a way, that every control word must lead to a successful derivation. Some results on using Chomsky-type grammars as both base and control grammars are already shown, and some new results are obtained.
Matrix grammars extended with appearance checking are universal, i.e., they can be used to generate every recursively enumerable language, however, from applications point of view special, decidable subclasses play important roles, e.g., matrix grammars without appearance checking [4], [2]. It has been shown that the family of context-free, exactly regular-controlled languages and the family of finite index matrix languages coincide and the language family is strictly contained in the family of matrix languages. The latter result states that regular control is not sufficient to describe matrix language derivations in an exact way. The question arises: what kind of control mechanism would be sufficient? We define a subfamily of matrix languages, with the property that there is at most one nonterminal allowed to be an exception under the finite index property. This subclass takes place between the family of finite index matrix languages and the family of arbitrary matrix languages. Matrix grammars in this language family are capable of generating the Dyck-language, which cannot be generated by any finite index matrix grammar. Moreover, we show that context-free control sets are sufficient to control this language family in an exact way.
Results on using various language classes that are orthogonal to the Chomsky-hierarchy [3], such as L-systems, as generating systems for control sets are also presented.

References

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