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INCOMPARABILITY RESULTS FOR CLASSES OF POLYNOMIAL TREE SERIES TRANSFORMATIONS

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ABSTRACT

Polynomial bottom-up and top-down tree series transducers over partially ordered semirings are considered, and the classes of ε -tree-to-tree-series (for short: ε -t-ts) and o-tree-to-tree-series (for short: o-t-ts) transformations computed by such transducers are compared. The main result is the following. Let \mathcal{A} be a weakly growing semiring and $x, y \in \{\text{deterministic}, \text{homomorphism}\}$. The class of o-t-ts transformations computed by x bottom-up tree series transducers over \mathcal{A} is incomparable (with respect to set inclusion) with the class of ε -t-ts transformations computed by y bottom-up tree series transducers over \mathcal{A} is incomparable (with respect to set inclusion) with the class of ε -t-ts transformations computed by y bottom-up tree series transducers over \mathcal{A} . Moreover, the latter class is incomparable with the class of ε -t-ts transformations computed by x top-down tree series transducers over \mathcal{A} . If additionally \mathcal{A} is additively idempotent, then the above statements even hold for every $x, y \in \{\text{polynomial, deterministic, homomorphism}\}$.

Keywords: Tree transducer, weighted tree automaton, partially ordered semiring

1. Introduction

Tree series transducers [40, 19, 25, 27] were introduced as a joint generalization of tree transducers [45, 47, 16] and weighted tree automata [46, 38, 7]. Both historical predecessors of tree series transducers have successfully been motivated from and applied in practice. Specifically, tree transducers are motivated from syntax-directed translations in compilers [33, 17, 26], and they are applied in, e. g., functional program analysis and transformation [37, 30, 34, 48], computational linguistics [43, 36, 42, 35], generation of pictures [11, 12], and query languages of XML databases [3, 20]. Weighted tree automata have been applied to code selection in compilers [24, 5] and tree pattern matching [46]. Moreover, a rich theory of tree transducers was developed (see [16, 1, 18] as seminal papers and [28, 44, 9, 29, 26] as survey papers and monographs) during the seventies, whereas weighted tree automata just recently received some attention (e. g., [46, 38, 4, 6, 13, 14, 23, 15]).

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