A Decidable Logic For Transductions with Regular Synthesis

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Transductions are binary relations from finite input to finite output words. We introduce a logic, called $L_T$, to express properties of transductions. In this logic, the dependency between input and output words is modeled via an origin function which associates with any position of the output word, the input position from which it originates. The logic $L_T$ is expressive enough to define all MSO-definable functions of finite words, as defined by Courcelle, but also some interesting relations that are not definable by MSO-transducers, such as the shuffle, by which one obtains all permutations of a given input word. In this context a specification is given as an $L_T$ formula and the regular synthesis problem amounts to obtaining a functional transducer satisfying the specification. Despite the high expressive power of this logic we show that we can effectively uniformize an $L_T$ definable transduction.