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SYNCHRONIZATION FUNCTIONS OF SYNCHRONIZED CONTEXT-FREE GRAMMARS AND LANGUAGES [1]

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ABSTRACT

Synchronization functions are introduced to measure the amount of communication necessary to generate synchronized context-free (SCF) languages. The family of SCF languages with a bounded synchronization function equals the family of context-free languages and for non-context-free SCF languages, the synchronization function is proven to be at least linear and at most quadratic. Examples of SCF grammars with synchronization functions that are linear, quadratic and strictly between linear and quadratic are provided.

Keywords: Synchronization, ET0L languages, regulated rewriting, asymptotic bounds

1. Introduction

Context-free languages are among the best studied and understood families of formal languages. Unfortunately, their generative power is insufficient to model phenomena of formal and natural languages, see, e. g., [6]. Context-sensitive languages, the next level in the Chomsky-hierarchy, are so powerful that they become too difficult to handle. For this reason, different extensions of context-free grammars have been proposed, see, e. g., [6, 5, 1], in order to increase the generative capacity while maintaining as many of the desired properties of context-free languages as possible.

In [11], H. Jürgensen and K. Salomaa introduced a new extension of context-free grammars, synchronized context-free (SCF) grammars as well as block-synchronized context-free grammars, in which independent paths in a context-free derivation can communicate in order to synchronize by means of situation symbols. The idea of synchronization as a method of communication was proposed in a similar way for automata in [10].

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