REGULATIONS OF UNIFORMLY k-LIMITED ET0L SYSTEMS AND THEIR RELATIONS TO CONTROLLED CONTEXT-FREE GRAMMARS

Dietmar Wätjen

Institut für Theoretische Informatik, Technische Universität Braunschweig
Fallersleber-Tor-Wall 22, Postfach 3329, D-38023 Braunschweig, Germany
e-mail: waetjen@iti.cs.tu-bs.de

ABSTRACT

In this paper we consider different regulation mechanisms imposed upon uniformly k-limited ET0L systems. We investigate matrix, periodically time varying, graph-controlled, programmed and regularly controlled systems on the one side and random context and random context with appearance checking systems on the other side, as well as mixtures of these two types. For $k = 1$, we compare these systems with regulated context-free grammars as considered in the literature before. We establish equivalences between different such systems and grammars.

Keywords: Formal languages, limited T0L systems, regulated rewriting, regulated context-free grammars.

1. Introduction

In [16], we have considered regulated uniformly k-limited T0L systems. Similar regulations of k-limited ET0L systems have been already considered in [14], [5], [15]. In this paper, we shall extend the research of [16] to uniformly k-limited ET0L systems and investigate their relations to regulated context-free grammars.

We consider different forms of regulations, such as programmed, matrix, time varying, regularly controlled or random context uniformly k-limited ET0L systems or context-free grammars. In case of context-free grammars, the regulation mechanisms are imposed upon the productions. A comprehensive presentation of such grammars is given in [10] or [3]. In case of the uniformly k-limited ET0L systems (abbreviated as uklET0L systems), the regulations are imposed upon the tables. This is in accordance with the regulation mechanisms of T0L systems (see [1], [2], [3], [7], [8], [9], [11]) or k-limited ET0L systems (see [14], [5]).

In section 2, the necessary definitions are given. In section 3, the families of regulated uklET0L languages are investigated. As a main result we get that for all $k \in \mathbb{N}$, the family of random context uklET0L systems with appearance checking and with or without one of the further regulations considered in this paper equals the family $\mathscr{L}(\mathrm{re})$ of recursively enumerable languages. We recognize in section 4 that some of