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ON LINDENMAYER SYSTEMS WITH DYNAMIC CONTROL OF PARALLELISM

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ABSTRACT

M-rate 0L systems are interactionless Lindenmayer systems together with a function assigning to every string a set of multisets of productions that may be applied simultaneously to the string. Also tabled and extended variants of M-rate 0L systems are considered. Some results concerning the computational power of these systems are presented supplementing those contained in [1].

Keywords: parallel rewriting, Lindenmayer systems, restricted parallelism, developmental systems, formal languages

1. Introduction

The theory of Lindenmayer systems originates from [9]. Various classes of *Lindenmayer systems* (L systems, for short) have been introduced to model the biological development of lower organisms [6]. Subsequently a sophisticated mathematical theory of L systems has been established [10].

Whereas in Chomsky grammars the derivation process is sequential, that is a single occurrence of a symbol or a substring of the sentential form is replaced according to a production, in Lindenmayer systems all symbols of the strings are replaced simultaneously. Thus, a finite substitution is repeatedly applied by those mechanisms. This reflects the intuition that cells or other atomic building blocks of organisms develop in parallel.

To capture the fact that, in many cases, the ability of cells to develop may depend on their inner states or other local conditions, controlled variants of Lindenmayer systems were introduced, see [2] or [4] for examples. In [1], the authors also propose models that allow to control the amount of parallelism used during developmental steps, guided by the state of the organism under development, that is, by the string