

DESCRIPTIONAL COMPLEXITY OF REWRITING P SYSTEMS¹

MUTYAM MADHU

*International Institute of Information Technology
Gachibowli, Hyderabad-19, India
e-mail: madhu_mutyam@iiit.net*

ABSTRACT

In this paper we generalize to rewriting P systems some measures of descriptonal complexity defined for context-free grammars and analyze these measures in lieu with those for the context-free grammars.

Keywords: Rewriting P systems, context-free grammars, descriptonal complexity

1. Introduction

Natural computing is a field of research which tries to imitate nature's way of computing. It strives to offer new models and paradigms of computing inspired to those used by nature.

P systems [10] is a branch of natural computing which abstracts from the structure and the functioning of living cells. Cells contain several compartments which in turn contain chemical compounds. The chemical compounds are processed by using chemical reactions. In correspondence to the structure and the functioning of a cell, a P system has a *membrane structure* consisting of several cell-like membranes which are hierarchically embedded in a main membrane, called the *skin membrane*. Membranes with no other membranes embedded in them are called *elementary*. The membranes delimit *regions*, where we place *objects* and evolution rules. Using evolution rules, objects can be created or destroyed or even sent to neighboring membranes. Based on the type of objects and the type of evolution rules several variants of P systems are defined. One such variant is *rewriting P systems* [10], motivated from the fact that the structure of the DNA molecules in a cell can be described by a string. In rewriting P systems, we consider strings as objects and context-free rules as evolution rules. All strings are processed in parallel, but each single string is rewritten by only one rule. The parallelism is maximal at the level of strings and rules, but the rewriting is sequential at the level of the symbols in each string.

¹Full version of a submission presented at the 4th Workshop on *Descriptonal Complexity of Automata, Grammars and Related Structures* (London, Ontario, Canada, August 21–24, 2002).