

# ON THE DESCRIPTIONAL COMPLEXITY OF EXTERNAL HYBRID COOPERATING DISTRIBUTED GRAMMAR SYSTEMS<sup>1</sup>

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## ABSTRACT

In this paper we investigate descriptonal complexity aspects of external hybrid cooperating distributed (CD) grammar systems. An external hybrid CD grammar system consists of several grammars called components. The cooperation between the components is controlled by the derivation mode that determines when a component becomes active or inactive. We set our focus on the number of components and the maximum number of productions in a component. For some external hybrid CD grammar systems it is possible to find equivalent systems that consist of only five components. For these external hybrid CD grammar systems we can also construct equivalent systems with at most six productions in a component. If one of the two parameters is fixed, the other one induces an infinite hierarchy of language classes.

*Keywords:* Grammar system, descriptonal complexity, hybrid derivation modes

## 1. Introduction

In classical formal language theory the generation of languages is investigated. For this purpose “central” devices like automata and grammars are regarded. However, nowadays, various fields of computer science have to deal with more complex systems. Here the tasks are distributed among a set of “processing units” which are working together in a well defined way. The concept of distribution was carried over to formal language theory by introducing grammar systems.

Cooperating distributed grammar systems (CD grammar systems in short) are a widely investigated field and a good overview of the topic can be found in [2] or in [4]. Context-free CD grammar systems can be considered as a generalization of context-free grammars and consist of several components where each of the components is a context-free grammar. The so-called derivation mode determines how the components cooperate. In the derivation mode it is defined how long productions of one component

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