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ARRAY GRAMMARS AND AUTOMATA ON CAYLEX GRIDS

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ABSTRACT

In this paper, we define arrays on Cayley grids of finitely presented groups as well as array grammars and array automata for sets of such arrays. For any finitely presented group having an element of infinite degree, we show that the families of array languages of arrays defined on the corresponding Cayley graph and generated by arbitrary, monotone, context-free, and regular array grammars form a Chomsky-like hierarchy. Moreover, we show that in this case, with the additional requirement for the group presentation to be recursive, the family of recursively enumerable k-connected array languages coincides with the family of k-connected array languages generated by arbitrary array grammars as well as with the family accepted by array automata, even by deterministic ones.

Keywords: Arrays, Automata, Cayley graph, Grammars

1. Introduction

As a natural extension of string languages (e. g., see [12, 13]), arrays on the d-dimensional grid $\mathbb{Z}^d$ have been introduced, and the correspondence between array grammars generating and array automata accepting k-connected arrays have been investigated since more than four decades, for example, see [3, 9]. Applications of array grammars and array automata especially can be found in the area of pattern and picture recognition, for instance, see [10, 11, 15].

Following the ideas of Erzsébet Csuhaj-Varjú and Victor Mitrana ([4]) initiated and communicated to us around one decade ago, we started to investigate arrays on Cayley grids of finitely presented groups; first definitions and results can be found in [6]. As a first example of arrays on a Cayley grid of a non-Abelian group we refer to [1], where arrays on the hexagonal grid were considered.