Journal of Automata, Languages and Combinatorics 11 (2006) 2, 161–168 © Otto-von-Guericke-Universität Magdeburg

## ON ASYNCHRONOUS TREE AUTOMATA<sup>1</sup>

FERENCE GÉCSEG and BALÁZS IMREH<sup>2</sup>

Department of Informatics, University of Szeged Árpád tér 2, H-6720 Szeged, Hungary e-mail: {gecseg, imreh}@inf.u-szeged.hu

## ABSTRACT

In this work we introduce asynchronous tree automata. First isomorphically complete systems for the class of asynchronous tree automata are characterized with respect to the  $\alpha_i$ -products, then tree languages recognizable by asynchronous tree automata are described.

Keywords: Algebraic theory of automata, tree automata

## 1. Introduction

Asynchronous automata have been studied from different aspects. Regarding the decomposition of asynchronous automata we mention here only the papers [2] and [3] which deal with the decomposition of an arbitrary automaton into a composition of two smaller automata one of which is asynchronous. For isomorphically complete systems and languages recognized by asynchronous automata we refer to [9]. Here we define asynchronous tree automata and, by using the same argument as in [6], characterize isomorphically complete systems for the class of asynchronous tree automata with respect to the  $\alpha_i$ -products. Finally, tree languages recognizable by asynchronous tree automata are described.

## 2. Preliminaries

By an *automaton* we mean a pair  $\mathbf{A} = (A, X)$ , where A is a finite nonempty set of *states*, X is a finite nonempty set of the *input symbols*, and every  $x \in X$  is realized as a unary operation  $x^{\mathbf{A}} : A \to A$ . If **A** is known from the context, we write simply ax for  $ax^{\mathbf{A}}$ . An automaton  $\mathbf{A} = (A, X)$  is called *asynchronous*, if axx = ax, for all  $a \in A$  and  $x \in X$ .

 $<sup>^1\</sup>mathrm{This}$  work has been supported by the Hungarian National Foundation for Science Research, Grant T0 48786.

 $<sup>^2\</sup>mathrm{Balázs}$  Imreh deceased on 8-th of August 2006. The first named author dedicates the paper to his memory.