

## ON THE DECIDABILITY PROBLEMS OF ECO-GRAMMAR SYSTEMS<sup>1,2</sup>

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### ABSTRACT

(Un)decidability of the finiteness and emptiness problem of some (extended) conditional tabled eco-grammar (CTEG) system language families is shown. The tiling problem is used as a tool for the undecidability proof in the case of non-extended eco-grammar systems. It is shown that forbidding CTEG systems with a forbidding context of length 2 can generate all possible tilings of the plane by Wang tiles (dominoes). The known (un)decidability results of these language families are summarized in two tables.

*Keywords:* Formal languages, eco-grammar systems, tiling problem, finiteness problem, emptiness problem.

### 1. Introduction

Eco-grammar systems have been studied since 1994 as a grammatical formalism of rich potential. Original motivation came from modelling the interactions of an eco-system and the organisms living in it. They have been presented first at [2], and in the past works ([7, 3] and others) several variants have been proposed, particularly *conditional tabled eco-grammar systems*.

The basic model does not consider nonterminal symbols; allowing them, we obtain *extended* systems, motivated by the possibility that sometimes we are interested in some stages of the development of the system only.

We prove the (un)decidability of the finiteness problem for some of *CTEG* language families. For some other families the (un)decidability follows from the previously published results, and the same holds for the emptiness problem.

### 2. Basic Definitions

We denote by  $V^*$  the free monoid generated by an alphabet  $V$ ;  $\lambda$  is the empty string,  $|x|$  is the length of  $x \in V^*$ ,  $|x|_a$  is the number of occurrences of the symbol  $a$  in

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