

## COLONIES AS SYSTEMS OF TURING MACHINES WITHOUT STATES<sup>1,2</sup>

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### ABSTRACT

The paper aims to propose a system of recognizing machines as a counterpart of colonies of grammars. After presenting two unsuccessful approaches, the author proposes systems of TURING machines without states as an adequate model. The class  $\mathcal{L}_{WS}$  of languages recognized by single TURING machines without states, as well as the class recognized by systems of such machines, is investigated. It is shown that the class  $\mathcal{L}_{WS}$  does not fit into the Chomsky hierarchy. Systems of TURING machines without states are proved to have the same generative power as conventional TURING machines.

*Keywords:* Colonies, TURING machine, Generative power.

### 1. Introduction

The paradigm of emergent functionality views intelligence as an emergent property of interactions of agents with their environments and with other agents and focuses on models of intelligence that share certain common characteristics with biological information processing systems rather than with classical VON-NEUMANN-style computing systems [1]. If the agent's choice of an action is situationally determined — in other words, pre-programmed or in some way 'hardwired' — then they can be described as non-deliberative or reactive ones. These terms imply that the agent has no internal representation of the environment, no explicit knowledge, etc., and that this all is implicitly embedded or pre-compiled into the agent's structure. An example of how successful may be the colony architecture is the robotic system HERBERT [2] performing a really complicated behavior in a real environment.

Soon after BROOKS has published his idea on cooperating simple agents producing intelligent emergent behaviour, his idea has been applied to formal languages theory. Colonies of cooperating simple grammars were studied, in particular by E. CSUHÁJ-VARJÚ, J. DASSOW, J. KELEMEN, A. KELEMENOVÁ and GH. PĂUN [3, 5, 6, 7].

The objective of the present article is to apply the idea of cooperating agents on recognizing machines and to construct systems analogous to colonies of grammars.

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