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UNRELIABLE COLONIES – THE SEQUENTIAL CASE¹

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ABSTRACT

A colony is a formal model of reactive systems which usually act in a real world. The unreliability is an important and typical feature of reactive systems. In this paper we discuss a possibility to add unreliability into colonies. Stochastic regular grammars are used to enhance the architecture of colonies and to establish the model of unreliable colonies. Some properties of this model are examined, including relations of languages and classes of languages between several types of models of (unreliable) colonies.

Keywords: Unreliable colony, colony, reliability, stochastic grammar, grammar system.

1. Introduction

Real environments are typically dynamic and uncertain, their effects are not always acceptably predictable. Moreover, reactive systems which operate in such environments are able to sense them only imperfectly. Real agents are often malfunctioning due to the bugs in their construction or other unpredictable causes. These are the main arguments why there is a need for a formal model of reactive systems which includes some "unreliability" or "error rating".

In the framework of the theory of formal languages, stochastic formal languages are used to describe the noisy and distorted patterns [3]. A probability computed through the derivation process is assigned to every string in a language and is used to characterize the uncertainty and randomness of a language. This paper proposes to use stochastic languages to express the unreliability in grammar-theoretic models of reactive systems as presented in [6].

In [7], the formal model of reactive systems based on the theory of grammar systems [2] is proposed. A reactive system consists of simple components communicating only through a shared environment. Colonies as models of reactive systems comprise components in the form of regular grammars which operate on common sentential form in sequential or parallel manner (in this paper just sequential colonies are considered) and generate finite languages only.

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