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Generating the syntactic and semantics graphs for a Markovian process algebra

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Abstract

We present a couple of programs (over C and *Mathematica*) which allow to generate the syntactic and the semantics representations of a ROSA (**R**easoning **O**n **S**tochastic **A**lgebras) process.

ROSA is a Markovian process algebra for the description and analysis of probabilistic and non-deterministic concurrent processes. ROSA allows us to evaluate performance indexes as well as to check some temporal requirements. As application, we analyse the alternating bit protocol obtaining the average time to send a message, considering that channels may fail with a known probability.

Keywords: Theoretical computer science; Formal methods; Non-deterministic and probabilistic aspects; Stochastic process algebra; Performance analysis; Real-time requirements; Design specifications; Fault tolerance; Case studies

1. Introduction

Process algebras are mathematical theories which model concurrent systems by their algebra and provide apparatus for reasoning about the structure and behaviour of the model. Examples include the calculus of communicating systems (CCS) [8,9], communicating sequential processes (CSP) [5,6], algebra of communicating processes (ACP) [1] and example process language (EPL) [4]. A system is characterized by its active components and their *interactions* or *communications*, between each other. Unlike Queuing Networks or Petri Nets there is no notion of *entity* or *flow* within a model. However, in recompense compositional reasoning, it is an intrinsic part of the language.

Both CCS and CSP could be two of the most representative examples of classical process algebras, thus, in the eighties fundamentals in process algebras were firmly established, but the proliferation of distributed, real-time and fault-tolerant systems has generated a great interest in the definition of timed and probabilistic extensions of these models.

Due to this fact, we find that currently it is not enough to consider qualitative aspects of concurrent systems. Thus, several researchers have studied possible extensions of these models by including some quantitative factors, like time restrictions, priorities and probabilities.

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