Principles of Transforming Communicating X-Machines to Population P Systems

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Abstract

Population P Systems is a class of P Systems in which cells are arranged in a graph rather than a hierarchical structure. On the other hand, Communicating X-machines are state-based machines, extended with a memory structure and transition functions instead of simple inputs, which communicate via message passing. One could use Communicating X-machines to create system models built out of components in a rather intuitive way. It is worth investigating how existing Communication X-machine models can be transformed to Population P system models so that we could take advantage of the dynamic features of the latter. In this paper, we attempt to define the principles of transforming Communicating X-machines to Population P Systems. We describe the rules that govern such transformation and we present an example in order to demonstrate the feasibility of the transformation and discuss its advantages and shortcomings.

1 Introduction

In the last years, attempts have been made to devise computational models in the form of generative devices, such as P systems [13] and its variants. These new computational paradigms have been used to solve well-known hard problems. Occasionally, some attempts also have been made to use P Systems towards modelling of swarm-based multi-agent systems [14], in order to take advantage of the reconfiguration features of P systems, such as cell death, cell division, reconfiguration of structure etc. The main problem which appears in such modelling activity is that the model resulting for the object interaction within a cell is not always easy to develop. On the other hand, state-based models provide the necessary "intuitiveness" to model the behaviour of system components or agents. For instance, communicating X-machines have been used as a suitable paradigm of modelling agent based specification [11].

As a natural consequence of the above complementary features is to either try to combine both formalisms [17, 18] or to transform one formalism to another. The