Event-B models of P systems

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Abstract

Event-B is a notation used for developing mathematical models of complex system which behave in a discrete fashion. It is to be used with the Rodin platform.

Membrane computing, the research field initiated by Gheorghe Păun in 1998, aims to define computational models, called P systems, which are inspired by the behavior and structure of the living cell. Since its introduction, the P system model has been intensively studied and developed.

In this paper we provide introductory ideas about modelling some P-systems using the Event-B formalism.

First of all, we model some very simple P-systems with one membrane and non-cooperative rules. After that more complicated P-systems will be considered.

We will use two kinds of modelling: a direct one, in which for each rule we will introduce an event in the model, and a more complex one, in which we transform the P systems under discussion into a Kripke structure. The second approach is often used in the literature for model checking of P systems.

A big advantage of the Rodin platform is the automatic generation of proof obligations and the proving mechanism which allows immediate correction. In this way, before using it for model checking, we have the guarantee of a formally correct model.

Testing is an essential part of software development. The idea of testing using model checkers is to interpret counterexamples as test cases. This technique has also been recently applied to P systems and we will provide some ideas about how to use the Event-B model of a P system and the the associated model checker, ProB, for this purpose.