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## Transforming Communicating X-machines into P Systems

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**Abstract** Tissue P systems represent 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 models built out of components in a rather intuitive way. There are investigations showing how various classes of P systems can be modelled as communicating X-machines. In this paper, we define a set of principles to transform communicating X-machines into Tissue P systems. We describe the rules that govern such transformations, present an example to demonstrate the feasibility of this approach and discuss ways to extend it to more general models, such as population P systems, which involve dynamic structures.

**Keywords** P systems · X-machines · nature-inspired computation · multi-agent systems for natural phenomena

### 1 Introduction

In the last years, a nature-inspired computational paradigm, called P systems (Păun 2000), abstracting from the structure and functionality of the living cell has been intensively and extensively studied and numerous variants have been considered. They have been investigated for their computational power and complexity aspects (Păun 2002), used to solve hard problems, model various biological systems and provide solutions to questions in different areas. Occasionally, some attempts have been made to use P systems towards modelling swarm-based multi-agent systems (Stamatopoulou et al 2005a), in order to take advantage of the structure and reconfiguration features of P systems, such as cell death, cell division,

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