1 Cell-like and Tissue-like Membrane Systems as Recognizer Devices

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Abstract. *Most of the variants of membrane systems found in the literature are generally thought as generating devices. In this paper recognizer computational devices (cell–like and tissue–like) are presented in the framework of Membrane Computing, using the biological membranes arranged hierarchically, inspired from the structure of the cell, and using the biological membranes placed in the nodes of a graph, inspired from the cell inter–communication in tissues. In this context, polynomial complexity classes of recognizer membrane systems are introduced. The paper also addresses the* **P** *versus* **NP** *problem, and the (efficient) solvability of computationally hard problems, in the framework of these new complexity classes.*

1.1 Introduction

One of the main goals of a computing model is to solve problems. In order to design computational devices capable of attacking decision problems, we must decide how to represent by strings the instances of the problem. In that context, to solve a decision problem consists of recognizing the language associated with it.

Membrane Computing is a young branch of Natural Computing providing distributed parallel computing models whose computational devices are called *membrane systems*, which are inspired by some basic biological features, by the structure and functioning of the living cells, as well as from the cooperation of cells in tissues, organs, and organisms.

In this area there are basically two ways to consider computational devices: cell–like membrane systems and tissue–like membrane systems. The first one, using the biological membranes arranged hierarchically, inspired from the structure of the cell, and the second one using the biological membranes placed in the nodes of a graph, inspired from the cell inter–communication in tissues.

In this paper we present recognizer membrane systems (both cell–like and tissue–like variants) as a framework to address ways to efficiently solving computationally hard problems, capturing the true concept of algorithm in spite of providing a non–deterministic computing model.

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