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Special Issue on Membrane Computing

Fifth brainstorming week on membrane computing

The present volume contains a selection of papers resulting from the Fifth Brainstorming Week on Membrane Computing (BWMC5), held in Sevilla, from February 4 to February 8, 2008. The meeting was organized by the Research Group on Natural Computing (RGNC) from Department of Computer Science and Artificial Intelligence of Sevilla University, and it was dedicated to the memory of Nadia Busi, one of the most active researchers in membrane computing, who passed away in September 2007, when she was only 39 years old.

The previous editions of this series of meetings were organized in Tarragona (2003), and Sevilla (2004 – 2007), and on those occasions special issues of *Natural Computing* (volume 2, number 3, 2003), *New Generation Computing* (volume 22, number 4, 2004), *Journal of Universal Computer Science* (volume 10, number 5, 2004), *Soft Computing* (volume 9, number 9, 2005), *International Journal of Foundations of Computer Science* (volume 17, number 1, 2006), and *Theoretical Computer Science* (volume 372, numbers 2-3, 2007) were published.

Membrane computing is a branch of natural computing which studies models of computation inspired by the structure and functioning of living cells, and organization of cells in tissues and other structures. The resulting models (called P systems) are distributed parallel computing devices, processing multisets in compartments defined by membranes. Many bio-inspired ingredients and features of P systems were considered. For instance, the multisets of objects can evolve by multiset rewriting rules similar to bio-chemical reactions, by symport/antiport rules, or by other types of rules, the membranes themselves can change in time, by division, creation, endo-, exo-cytosis, and so on. Most classes of P systems are computationally universal and, if an exponential working space can be produced in polynomial time (e.g., by membrane division), then they are able to solve computationally hard problems in a feasible time. A series of applications were recently reported, especially in biology and medicine, but also in computer graphics, cryptography, linguistics, economics, approximate optimization, etc. Several simulation programs (useful in applications) are available by now. A comprehensive information about this research area (considered in 2003 by ISI as "fast emerging research front in computer science") can be found at the Website `http://ppage.psystems.eu`.

At this web address one can also find the volume published in 2008 by Fenix Editora, Sevilla, with *all* papers resulting from BWMC5. As usual, the meeting was extremely successful, in both the number of participants – about 45 – and, especially, the efficiency of interaction, with many discussions and considerable joint work, with many papers either continued or initiated during the meeting.

For the present volume we have selected only a few of these papers; they have been thoroughly reworked after the meeting and then they went through the standard refereeing procedure of the journal. All selected papers are significantly contributing to the development of the field. The topics range from basic issues (such as looking for normal forms which preserve the behavior of P systems, and estimating the complexity of assigning objects to rules in a specific variant of maximal parallelism), to complexity issues (solving **NP**-complete problems in a feasible time, by standard P systems and by spiking neural P systems), new ideas (such as considering arbitrarily large pre-computed resources, used in solving computationally hard problems), applications (in sorting and, especially, in devising approximate algorithms of an evolutionary computing type using suggestions from quantum computing and membrane computing).

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