

Foreword: asynchronous cellular automata and nature-inspired computation

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This volume contains five papers presented during two workshops, “First International Workshop on Asynchronous Cellular Automata” (ACA 2010) and “Fifth International Workshop on Natural Computing” (IWNC 2010), held at the 9th International Conference on Cellular Automata for Research and Industry (ACRI 2010) in Ascoli Piceno (Italy) in the period September 21–24th, 2010.

The ACA workshop is devoted to the theme of asynchrony inside Cellular Automata. Cellular Automata are a well-known formal tool for modeling complex systems; they are considered in many scientific fields and industrial applications. Synchronicity is one of the main features of Cellular Automata evolutions. Indeed, in the most common Cellular Automata framework, all cells are updated simultaneously at each discrete time step. Recent trends consider the modeling of asynchronous systems based on local interactions. The

aim of this workshop is to bring together researchers dealing with the theme of the asynchrony inside Cellular Automata.

The IWNC workshop is concerned with theoretical as well as experimental studies of nature-inspired paradigms of computations. More precisely, the scientific field of Natural Computing encompasses theoretical and experimental investigations of nature-inspired principles of information processing, novel and emerging paradigms of computation and computing architectures, and case studies of simulated or real-world computing devices implemented in biological, social, chemical, engineering, and physical systems.

Typical, but not exclusive, topics of the two workshops are: various aspects of asynchronous cellular automata (dynamics, complexity and computational issues, emergent properties, models of parallelism and distributed systems, models of real phenomena) and nature-inspired computation and communication (DNA computation, cellular automata, physics of computation, computation in living cells, nanocomputing, evolutionary computing, artificial chemistry, neural computation).

After an additional review process, three papers from the ACA workshop and two from the IWNC workshop were selected and included in this special issue. They are now presented in an extended and improved form with respect to the already refereed workshop version that appeared in the proceedings of the ACRI 2010 conference. The paper by L. Manzoni is about the dynamical behavior of asynchronous cellular automata. The classical cellular automata properties are adapted to the synchronous case and related results are shown. In their paper, S. Bandini et al. give an analysis of different update schemes for asynchronous cellular automata and discuss the respective effects by means of the class of 1D cellular automata. L. Vanneschi et al. deal with genetic algorithms to evolve asynchronous cellular automata and focus on learning

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robustness with respect to the synchronous case. In the article by J. B. Yunès it is shown how universal computations can be achieved on one-dimensional cellular automata and a universal brick used in grids is given—it allows to obtain intrinsic universal cellular automata. The article by Sahu et al. discusses a molecular cellular automaton recently introduced by the authors and shows novel

features that have never been proposed in conventional CA models.

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