

Laudatio

2019 SIROCCO Prize for Innovation in Distributed Computing

It is a pleasure to award the 2019 SIROCCO Prize for Innovation in Distributed Computing to Paola Flocchini. Paola is a well-known member of the distributed computing community and her work is very closely related to SIROCCO's area of interest, i.e., the relationships between information and efficiency in decentralized computing. Most of her research can be divided into two parts. The first is the analysis of a property of labeled graphs called "sense of direction". This property which is a generalization of the orientation of rings or grids to arbitrary graphs, turns out to have major impacts on complexity and computational feasibility of communication systems. Paola's first publication on this topic [1] appeared in the first edition of SIROCCO and its journal version was later published in [2]. After that introductory paper, she wrote over 20 other papers focused on sense of direction, further exploring the impact of this property in distributed computations, all published in international conferences and top level international journals, such as the SICOMP paper [3].

The core of this part of Paola Flocchini's scientific work showed the dramatic effect that sense of direction has on the communication complexity of several important distributed problems, such as broadcast, depth-first traversal, election, spanning tree construction, in several classes of graphs. Before the seminal 1994 paper, an extensive body of evidence existed on the impact that specific edge labelings have on the communication complexity of distributed problems, suggesting that these (very different) labelings shared a common property. However, despite the obvious practical importance, a formal characterization of this property did not exist. Thus, the impact of this paper has been to provide a formal definition of sense of direction, defining those properties which make it possible to reduce the communication complexity in a distributed scenario. The final outcome of this work was to make explicit the very specific relationship between three factors: the labeling, the topological structure, and the local view that an entity has of the system.

Paola's work on sense of direction attracted a lot of attention in the distributed computing community, and generated a substantial amount of follow-up, producing a great body of scientific effort on this topic, as witnessed by over 150 citations (SCOPUS) of Paola's papers related to this matter.

The second important part of Paola's work concerns the theory of computation by autonomous mobile agents, i.e., distributed systems populated by moving and computing entities, that aim at solving various tasks. She contributed to the study of such entities both in the continuous setting (robots moving on a 2D plane), and in the discrete setting (agents acting in a network). In the continuous setting, she co-created the asynchronous oblivious mobile robots model called ASYNCH, and then studied several problems in this model, such as the gathering and the arbitrary pattern formation problem. She published over 20 papers on this topic, that collected more than 650 citations (SCOPUS), witnessing again the great interest of the distributed computing community in this area. One of the first of Paola's papers on mobile robots [4] was published in SIROCCO, and one of the most influential of

her papers on asynchronous robots computing was the SICOMP paper [5].

Paola's body of work on mobile agents stimulated a lot of subsequent research, contributing to the development of this field, witnessed by numerous citations, and by establishing of the Moving and Computing international workshops, that periodically gather researchers from the distributed computing community interested in mobile agents computing.

We award the 2019 SIROCCO Prize for Innovation in Distributed Computing to Paola Flocchini for her contributions to the study of sense of direction in labeled graphs and to the analysis of asynchronous systems of mobile agents.

The 2019 Award committee¹

Shantanu Das (Aix-Marseille Université)

Pierre Fraigniaud (Université Paris Diderot, CNRS)

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Christian Scheideler (Paderborn University)

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Sébastien Tixeuil (Sorbonne Université)

Selected publications related to Paola Flocchini's contribution:

1. P. Flocchini, B. Mans, N. Santoro,
Sense of Direction: Formal Definitions and Properties,
Proc. 1st Colloquium on Structural Information and Communication Complexity,
(SIROCCO 94), 9-33, 1994.
2. P. Flocchini, B. Mans, N. Santoro
Sense of Direction: Definitions, Properties, and Classes,
Networks 32(3), 165-180, 1998.
3. P. Flocchini, A. Roncato, N. Santoro,
Sense of Direction and Backward Consistency in Advanced Distributed Systems,
SIAM Journal on Computing 32(2), 281-306, 2003.
4. P. Flocchini, G. Prencipe, N. Santoro, P. Widmayer,
Pattern Formation by Anonymous Robots Without Chirality,
Proc. 8th International Colloquium on Structural Information and Communication
Complexity (SIROCCO 2001), 147-162, 2001.
5. M. Cieliebak, P. Flocchini, G. Prencipe, N. Santoro,
Distributed Computing by Mobile Robots: Gathering,
SIAM Journal on Computing, 41(4): 829-879, 2012.

¹We wish to thank the nominators for the nomination and for contributing heavily to this text.