



## Preface

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This special issue features a selection of distinguished papers presented at the 2023 annual International Conference on Membrane Computing, encompassing contributions from both the European chapter (CMC) and the Asian chapter (ACMC). Since its inception in 2000, the International Conference on Membrane Computing has evolved into a premier event under the auspices of the International Membrane Computing Society (IMCS). It serves as a vital forum for scientists to present their latest research findings, discuss emerging trends, and exchange ideas on various research questions in the field of membrane computing.

The 2023 Conference on Membrane Computing (CMC) was hosted by the Silesian University in Opava, Czech Republic, while the Asian Conference on Membrane Computing (ACMC) took place at Xihua University in Chengdu, China. Continuing the rich tradition of past conferences, the 2023 editions aimed to infuse new ideas and inspirations, highlighting multidisciplinary and innovative capacity. The conferences fostered a collaborative and friendly atmosphere, bringing together researchers from diverse backgrounds to enhance communication and cooperation. The papers selected for this special issue exemplify the breadth and depth of research presented at these conferences, highlighting the latest advancements and approaches in the field of membrane computing.

In “Prognostic prediction model for esophageal cancer based on probability membrane systems”, Suxia Jiang, Housheng Li, Yanfeng Wang, Junwei Sun, and Huaiyang Liu propose a multi-factor esophageal cancer prognosis

prediction model (PMS) based on probabilistic membrane systems.

In “Computational completeness of sequential spiking neural P systems with autapses with partial synchronization”, Hong Peng, Hang Zhou, Yafei Liu, and Bin Zhou focus on studying the computational completeness of sequential SNP-AU with partial synchronization.

In “Pure 2D Eilenberg P systems”, Somnath Bera, Atulya K. Nagar, K. G. Subramanian, and Gexiang Zhang examine the array language generating power of Eilenberg P system with rectangular picture array objects and pure 2D context-free rules.

In “On simulation of the 2D P colony with evolving environment”, Miroslav Langer, Daniel Valenta, and Pawan Kumar Patnaik present a development of a simulator of a 2D P colony with the evolving environment.

In “Solving the SAT problem using spiking neural P systems with coloured spikes and division rules”, Prithwineel Paul and Petr Sosík consider a deterministic Spiking Neural P System model with colored spikes and neuron division rules, and provide an efficient solution to the SAT problem.

In “Parallel virus machines”, Antonio Ramírez-de-Arellano, David Orellana-Martín and Mario J. Pérez-Jiménez present a novel extension a parallel extension of virus machines.

In “Solving QUBO problems with cP systems”, Lucie Cencialová, Michael J. Dinneen, Radu Nicolescu, and Ludek Cenciala consider the use of cP systems to provide an efficient parallel solution to the integer-valued quadratic unconstrained Boolean optimization (QUBO) problem.

In “Queens of the Hill”, Artiom Alhazov, Sergiu Ivanov, and David Orellana-Martín propose a framework for the organization of king of the hill-style tournaments between P systems.

In “Simple variants of non-cooperative polymorphic P systems”, Anna Kuczuk and Gyorgy Vaszil investigate the computational power of non-cooperative polymorphic P systems with no additional ingredients.

In “Universality of a surface chemical reaction network using only bi-molecular reactions”, Sihai Yu, Jia Lee, and

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Teijiro Isokawa propose a novel simple model of surface chemical reaction networks using only ten species and ten reactions.

In “Random walk simulation by population dynamics P systems”, David Orellana Martín, José A. Andreu-Guzmán, Carmen Graciani, Agustí Riscos-Núñez, and Mario J. Pérez-Jiménez introduce generic PDP systems for simulating the behavior of particles, both for one- and two-dimensional spaces.

In “P systems with reactive membranes”, Artiom Alhazov, Rudolf Freund, Sergiu Ivanov, David Orellana-Martín, Antonio Ramírez-de-Arellano, and José-Antonio Rodríguez-Gallego propose a new variant of P systems with reactive membranes that can split and merge. They show that such actions do not seem to radically affect the computational power of these systems.

In “Medium-long-term electricity load forecasting based on NSNP systems and attention mechanism”, Lin Guo, Jun Wang, Hong Peng, and Yunzhu Gao propose a new Medium–Long-Term Load Forecast model LF-ASNP based on NSNP system and attention mechanism, which can accurately analyze the characteristics of historical load data and forecast the electrical load of power systems.

In “Implementing perceptrons by means of water-based computing”, Nicolás Civiero, Alec Henderson, Thomas Hinze, Radu Nicolescu, and Claudio Zandron discuss the possibility of realizing neural networks by means of water tanks and pipes.

In “Retinal vessels segmentation method based on dynamic threshold neural P systems with orientation feedback”, Can Jiang, Yihui Ren, Bo Yang, Hong Peng, and Xiaohui Luo propose a dynamic threshold neural P system model with orientation feedback which relies on the local orientation of retinal blood vessels calculated by the orientational vector fusion method, showing that this model has advantages in the segmentation of thin blood vessels.

In “Applications of Spiking Neural P Systems in Cybersecurity”, Mihail-Iulian Plesa, Marian Gheorghe, Florentin Ipate, and Gexiang Zhang propose a new architecture for cybersecurity data and problems and show that these networks can efficiently classify cybersecurity-related data.

In “Study on the Prognostic Model for Esophageal Cancer Survival Based on Blood Indicators and Probabilistic Membrane System”, Yanfeng Wang, Huaiyang Liu, Housheng Li, Suxia Jiang, and Junwei Sun design a probabilistic membrane system to establish a prognostic survival prediction model for esophageal cancer.

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**Linqiang Pan** received the Ph.D. degree from Nanjing University, China, in 2000. He has been a professor with School of Artificial Intelligence and Automation, Huazhong University of Science and Technology, Wuhan, China, since 2004. His main research interests include artificial intelligence, complex network, biological computing, and bioinformatics. Professor Pan is presently the vice dean of the Graduate School, Huazhong University of Science and Technology, and the editor-in-chief of

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**Jun Wang** is currently a professor at Xihua University. She received the Ph.D. degree in electrical engineering from Southwest Jiaotong University, Chengdu, China, in 2006. She is awarded “the academic and technical leader in Sichuan Province” and “Government Subsidy Expert, China”. Her research interests include new energy conversion technology, power electronic energy-saving technology, membrane computing and its application in the field of electrical engineering (some

achievements are at the international advanced level), intelligent control and automatic testing technology. She has published five books, over 20 invention patents and more than 200 scientific papers in international journals papers. She served as the head of three membrane computing projects funded by the National Natural Science Foundation of China, and collaborated with the University of Seville, Seville, and Spain. She is also a project review expert for the National Natural Science Foundation of China and the Ministry of Science and Technology, as well as a review expert for multiple international journals.



**Claudio Zandron** got the Ph.D. in computer science from the University of Milan in 2002. Since 2006, he is an associate professor at the Department of Informatics, Systems and Communication of the University of Milano-Bicocca, Italy. His research interests concern the areas of formal languages, molecular computing models, DNA computing, membrane computing, and computational complexity.

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**Gexiang Zhang** received his Ph.D. degree in 2005 from Southwest Jiaotong University, Chengdu, China. Now, he is a full professor at School of Automation, Chengdu University of Information Technology, Chengdu, China. He was a visiting professor in the Department of Computer Science, The University of Sheffield, UK, a senior visiting professor at the Department of Computer Science and Artificial Intelligence, University of Seville, Spain, and a visiting professor in Department of

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