Department of Electrical, Electronic and Computer Engineering	Key words	Distributed systems, fault-tolerant distributed algorithms, swarm robotics, mobile agents, mobile robots, algorithms, theoretical computer science

Doctor (Information Science) / Professor

Fukuhito Ooshita

Education

Osaka University, School of Engineering Science
Osaka University, Graduate School of Engineering Science, Master's Course
Osaka University, Graduate School of Information Science and Technology, Doctor's Course

Professional Background

Osaka University, assistant professor
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Consultations, Lectures, and Collaborative Research Themes

Efficient and resilient distributed systems, fault-tolerant distributed algorithms, mobile agents, mobile robots

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Main research themes and their characteristics

「Efficient and resilient algorithms for distributed systems」

Almost all systems in the world, including the Internet, are distributed systems, in which a large number of computational entities (computers, robots, etc.) operate cooperatively. We are developing efficient and resilient algorithms for various distributed systems such as computer networks, IoT, blockchain, mobile robots, and sensor networks.

(1) Self-stabilizing algorithms
Since distributed systems become larger and larger, it is inevitable that some computers or communication links in the systems fail. To cope with such faults, we are developing self-stabilizing algorithms. A self-stabilizing algorithm guarantees that, even if some computers or communication links in the system fail temporarily, the system automatically recovers without stopping the entire system (Figure 1). We have developed self-stabilizing algorithms for 1-maximal matching, link coloring, etc., and proposed general methods to design self-stabilizing algorithms.

(2) Cooperative algorithms for mobile robots
Mobile robots have various applications such as transporting goods in factories and warehouses and searching for persons in a disaster. We are developing algorithms for low-functional robots to realize various tasks. For example, we proposed exploration (Figure 2) and gathering algorithms for robots with limited visibility. We are also conducting experiments using actual mobile robots (Figure 3).

(3) Distributed algorithms for nano-scale systems
With the development of nanotechnology, nano-scale and molecular-scale systems are being realized. In fact, robots that can be swallowed, and molecular robots equipped with molecular-scale sensors and actuators, have been developed. These robots are expected to be used for medical applications by operating inside the body. In such systems, since each individual robot has very weak capabilities, it is necessary to operate a large number of robots cooperatively to realize useful tasks. We propose cooperative algorithms (such as group partition and leader election) using the population protocol model, which models nano-scale systems.

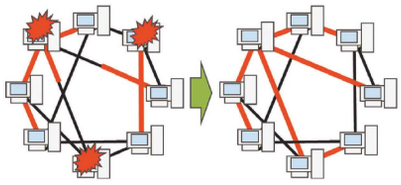

Fig.1 Self-stabilizing distributed algorithms

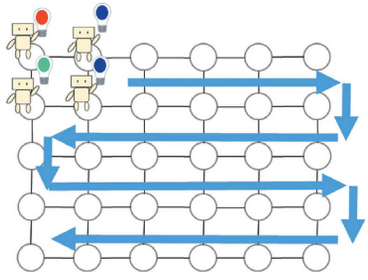

Fig.2 Exploration with luminous robots

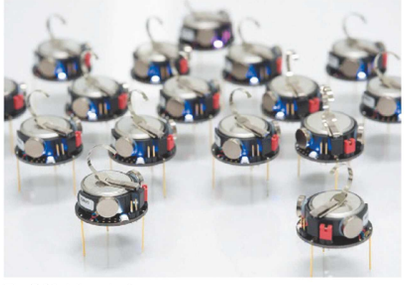

Fig.3 Mobile robots

Major academic publications

F. Ooshita and S. Tixeuil, "Ring exploration with myopic luminous robots", Information and Computation, available online, 2021.
H. Yasumi, F. Ooshita, M. Inoue, S. Tixeuil, "Uniform bipartition in the population protocol model with arbitrary graphs", Theoretical Computer Science, vol. 892, 2021.
Y. Sudo, F. Ooshita, T. Izumi, H. Kakugawa, T. Masuzawa, "Time-optimal leader election in population protocols", IEEE Transactions on Parallel and Distributed Systems, vol. 31, issue 11, 2020.