

KIOS Distinguished Lecture Series



Prof. Marco Dorigo

Université Libre de Bruxelles, Belgium



Friday, 28 November 2025,
at 14:30



Amphitheatre B102
“Elias Kyriakides”

Taming Self-Organization in Robot Swarms

LECTURE ABSTRACT

Fully self-organized robot swarms—operating without any central coordination—have been widely demonstrated. Their collective behavior emerges from local interactions among redundant agents, yielding scalability, fault tolerance, and no single point of failure. Yet, **self-organization is powerful but difficult to steer**. In this talk, I will discuss how we can tame self-organization without undermining its benefits. I will present a novel swarm architecture that achieves self-organized hierarchy, combining the robustness and scalability of decentralized systems with the controllability of centralized ones. Using a heterogeneous swarm of ground and aerial robots, I will demonstrate how the swarm can autonomously build and adapt a dynamic hierarchical control network through local asymmetric communication. Experimental results show that the architecture enables independent sub-swarms to form and merge, faulty robots to be seamlessly replaced, and collective behaviors to be modified on the fly—all while maintaining the key advantages of strict self-organization: scalability and robot interchangeability.

BRIEF BIO

Marco Dorigo received the Ph.D. degree in electronic engineering in 1992 from Politecnico di Milano, Milan, Italy. From 1992 to 1993, he was a Research Fellow at the International Computer Science Institute, Berkeley, CA. In 1993, he was a NATO-CNR Fellow, and from 1994 to 1996, a Marie Curie Fellow. Since 1996, he has been a tenured Researcher of the FNRS, the Belgian National Funds for Scientific Research, and co-director of IRIDIA, the artificial intelligence laboratory of the ULB. His current research interests include swarm intelligence, swarm robotics, and metaheuristics for discrete optimization. He is the Founding Editor of Swarm Intelligence, and an Associate Editor or member of the Editorial Boards of many journals on computational intelligence and adaptive systems. Dr. Dorigo is a Fellow of the AAAI, EurAI, and IEEE. He was awarded the Italian Prize for Artificial Intelligence in 1996, the Marie Curie Excellence Award in 2003, the Dr. A. De Leeuw-Damry-Bourlart award in applied sciences in 2005, the Cajastur International Prize for Soft Computing in 2007, an ERC Advanced Grant in 2010, the IEEE Frank Rosenblatt Award in 2015, and the IEEE Evolutionary Computation Pioneer Award, awarded in 2016.



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