SWARM INTELLIGENCE AND SWARM ROBOTICS
The Swarm-Bot Experiment

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Abstract: Swarm intelligence is the discipline that deals with natural and artificial systems composed of many individuals that coordinate using decentralized control and self-organization. In particular, it focuses on the collective behaviors that result from the local interactions of the individuals with each other and with their environment. The characterizing property of a swarm intelligence system is its ability to act in a coordinated way without the presence of a coordinator or of an external controller. Swarm robotics could be defined as the application of swarm intelligence principles to the control of groups of robots. In this talk I will discuss results of Swarm-bots, an experiment in swarm robotics. A swarm-bot is an artifact composed of a swarm of assembled s-bots. The s-bots are mobile robots capable of connecting to, and disconnecting from, other s-bots. In the swarm-bot form, the s-bots are attached to each other and, when needed, become a single robotic system that can move and change its shape. S-bots have relatively simple sensors and motors and limited computational capabilities. A swarm-bot can solve problems that cannot be solved by s-bots alone. In the talk, I will shortly describe the s-bots hardware and the methodology we followed to develop algorithms for their control. Then I will focus on the capabilities of the swarm-bot robotic system by showing video recordings of some of the many experiments we performed to study coordinated movement, path formation, self-assembly, collective transport, shape formation, and other collective behaviors..

BRIEF BIOGRAPHY

Marco Dorigo received the Laurea (Master of Technology) degree in industrial technologies engineering in 1986 and the doctoral degree in information and systems electronic engineering in 1992 from Politecnico di Milano, Milan, Italy, and the title of Agrégé de l'Enseignement Supérieur, from the Université Libre de Bruxelles, Belgium, in 1995. From 1992 to 1993 he was a research fellow at the International Computer Science Institute of 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 Fund for Scientific Research, and a research director of IRIDIA-CoDE, the artificial intelligence laboratory of the Université Libre de Bruxelles. He is the inventor of the ant colony optimization metaheuristic. His current research interests include swarm intelligence, swarm robotics, and metaheuristics for discrete optimization. Dr. Dorigo is the Editor-in-Chief of the Swarm Intelligence journal. He is an Associate Editor for the IEEE Transactions on Evolutionary Computation, the IEEE Transactions on Systems, Man, and Cybernetics, and the ACM Transactions on Autonomous and Adaptive Systems. He is a member of the Editorial Board of numerous international journals, including: Adaptive Behavior, AI Communications, Artificial Life, Cognitive Systems Research, Evolutionary Computation, Information Sciences, Journal of Heuristics and Journal of Genetic Programming and Evolvable Machines. In 1996 he was awarded the Italian Prize for Artificial Intelligence, in 2003 the Marie Curie Excellence Award, and in 2005 the Dr A. De Leeuw-Damry-Bourlart award in applied sciences. He is a fellow of the IEEE and of the ECCAI, the European Coordinating Committee for Artificial Intelligence.