A Nonspatial Multi-Level Modeling Methodology for Embedded Swarm-Intelligent Systems

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Abstract:

In this seminar, I will first introduce the main principles of Swarm Intelligence, a new behavioral and computational paradigm originally inspired by social insects and other animal societies. I will then show how their application to artificial embedded platforms such as mobile multi-robot systems is not straightforward but, if carefully adapted, can lead to self-organized, fully distributed, and scalable collective control while maintaining individual autonomy and relative simplicity. I will then present one of the methodology based on multiple levels of abstraction we have developed to evaluate, control, and optimize the performances of miniature, mobile, embedded, swarm-intelligent systems. While I will support the discussion with concrete case studies all belonging to a specific class of swarm robotic experiments, the methodology presented can be applied to further swarm-intelligent, embedded platforms as long as its modeling assumptions are fulfilled. To illustrate this property, I will briefly describe two further examples concerned with supramolecular chemical systems and symbiotic artificial-naturals systems to which we successfully applied the same methodology. I will conclude the seminar by discussing advantages and limitations of the current methodology, including current work aiming at overcoming its limitations and increasing its generality.

References:

Note: all the papers are downloadable from http://swis.epfl.ch/publications/

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