EngOpt2018 - 6th International Conference on Engineering Optimization
Instituto Superior Técnico, Lisbon Portugal • 17-19 September, 2018
Editors: H.C. Rodrigues, J. Herskovits, C.M. Mota Soares, et al.

Abstract ID 1147

META-HEURISTIC ALGORITHM FOR COLLABORATIVE ROBOT SWARM APPLIED TO POLLUTION SCANNING UNDERWATER MISSIONS

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Keywords: Heuristic; Robotic Swarms; Optimization; Underwater robots; Scheduling

Abstract: In the last years robotic swarms have attracted high attention in the research community for the intelligent designing and planning of specific missions or operations. In this context, the so-called mission consists of the optimal design of task schedules and the intelligent allocation of resources subjected to certain operational conditions or environmental constraints. Nevertheless, the study of underwater robotic swarms has been very limited and therefore, the development of new strategies for the cooperation between robots are necessary in this field. This manuscript focuses on this issue by devising an evolutionary heuristic algorithm aimed at efficiently scheduling in robotic swarms, which cooperate to accomplish the scanning of an area. Concretely, the final goal is focused on monitoring a stain of salinity and pollution over a real-based scenario in the underwater environment. For that purpose, the algorithm will use a simulated software which models in real-time the levels of salinity and pollution in the specific location. Therefore, the proposed algorithm must be designed to 1) detect the stain within the specified location, 2) accurately model the stain in the time-dependent environment by means of a collaborative algorithm that minimizes price and cost (measured in terms of battery cost and time) of the overall mission. Moreover, realistic conditions are imposed, i.e., the robots have not the same capabilities to perform the tasks and the price, speed and the cost of executing a certain task depends on each robot. It is important to note that the normal scanning task for collaborative robotic swarms in the underwater field consists of dividing the global area into subareas in which each robot works, yielding to a faster inspection of the whole area. This paper focuses on the real collaboration between robotic swarms, i.e. the real-time scheduling of tasks based on the robots' positions and the evolution of the stain. Therefore, the robotic swarm is constantly reorganized depending on the above-mentioned conditions by means of calling other robots for reinforcing the scanning, changing the robots' positions or assigning new tasks to certain robots to optimally accomplish the mission.