ABSTRACT

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The interest of the academic community in solving highly complex problems has been growing in recent years, putting an emphasis on the use of Swarm Intelligence. The Swarm Intelligence has a biological inspiration, proposed from the social observation of self-organizing species such as ants, bees and termites. Cooperation is the central idea, it allows the solution of complex problems with the coordinated accomplishment of small tasks, which together lead to a common goal. This coordination is only possible with an efficient Task Allocation. The allocation should be dynamic, as it must react to the problem and swarm changes, and also to have a distributed and stochastic solution, respecting the biological collective behavior that inspired the Swarm Intelligence. Particle swarm optimization (PSO) is an optimization algorithm that meets these requirements by managing a set of particles that navigate in a limited search space where the particle's current position is a possible solution. The position of each particle is adaptive in function of its own experience and the experience of the others. Inspired by the PSO, the *Alocação Dinâmica de Tarefas em Cluster* (ADTC) algorithm was proposed. The algorithm ADTC assigns tasks to a group of robots in a totally distributed way, where each one will represent a particle and its position of the search space will represent a feasible allocation. Based on the PSO, the ADTC performs an oriented search of the space, using the same concept of adaptive speed. However, this process requires an intense exchange of information between robots, and can hinder the task allocation for large swarms. In this dissertation, we propose the use of the cluster communication topology, capable of optimizing the communication process between robots, making the allocation of tasks of large swarms. The results obtained using the cluster topology are compared to those obtained with the complete mesh topology, showing the impact of the communication optimization on the performance of the dynamic allocation of tasks. On average, the results show an optimization of 30%.

Keywords: Dynamic task allocation; Swarm robotics; Distributed computing; Swarm intelligence; communication topology; cluster.