Research Fellowship Title: "Development of a methodological framework based on max-plus algebra for modelling and control of a shoal of fish robots"

Research Project

The research activity will be focused on the study and development of solutions for modelling and controlling a shoal of fish robots, with special emphasis on its deployment in repetitive inspections and tasks. In many real situations, underwater robot teams formed by a variety of robots, with different actuation and sensory capacities, are required to patrol different points of interest according to a predetermined strategy and, in particular, each agent is required to perform a sequence of special tasks. In this context, it is convenient to reconsider the usual time-driven approach to the problem of modelling and controlling the team dynamics and to adopt a task-driven approach instead. Max-plus algebra provides the appropriate setting and the mathematical tools to effectively formalize and solve the problem dealt with in the new methodological perspective.

Research Activity Plan

The research activity will be developed according to the following plan.

i. Review of the state of the art in max-plus algebra application to modelling and control problems.

ii. Formalization of the model of the shoal of fish robots and of its tasks in a max-plus algebra framework.

iii. Formulation of the problem of controlling the behavior and the performance of the fish-robot shoal in terms of a model matching problem.

iv. Investigation of conditions for problem solvability.

v. Validation of the results in a simulation environment.