

Sharif University of Technology
Mechanical Engineering Department
M. Sc. Thesis

**Control of Experimental Swarm Robots for Identification, Imaging & 3D
Modeling Purposes**

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Abstract

The aim of this project is decentralized control of a group of robots (swarm robots); such that the aggregation maneuver, leader following, Identification and imaging the target, will be performed so good as to make a three-dimensional model of the target from these images. Swarm robots consist of a number of similar and limited features robots which interaction in a group of robots, will lead to special features for the group. Any agent of group decides what to do only with its local information from the environment. Swarm robots are more applicable for the jobs in which a distributed perception from the environments needed, for example space exploration and military operations.

In this study, using the concepts of artificial potential function a reference model for robot motion is presented, and then using the design of a sliding mode controller, the real robots will follow this reference model.

The present project is divided into two parts: theoretical and practical. The study aims to make theoretical and practical results as close as possible. Especially in controller design and simulations, we considered actual conditions and limitations of the robots. For this purpose, we considered the available signals for the feedback, discrete time implementation, and the saturation and dead-zone limitations of robots' DC-motors.

In the practical part, the robot control algorithms are implemented in a group of six robots which Mr. Shahsavari fabricated two members of this group under supervision of doctor Aria alasty. The control algorithms implemented using MPLAB IDE software on microcontrollers of robots to perform aggregation maneuver, leader following, and the identification of robot environment and rotations around the target.

A method for making three-dimensional model from two-dimensional images presented and images wick captured by the cameraman robot, used in order to form a 3D model of the target.

Keywords: *swarm robotics, artificial potential functions, model reference control system, sliding mode control, 3D modeling*