

1. Introduction and task

This team project has the goal to develop a first swarm behavior of the finken copters. For this task a simple base configuration of the copters is used. With this configuration the copters are able to hold a given height autonomously but only with a statically coded height. Furthermore the four copters are fixed in a cage at the edges of a square with thin lines that they can only move up and down. This reduces the implementation of the swarm behavior to finding the correct height.

The mentioned swarm behavior stands for cooperative holding of the same height for all four copters. This means that the copters will take off and then they should find each other at a not directly specified height. Rather this is a searching process with only predefined values for the upper and lower height boundaries of the searching area. This searching process is the first basic approach explained in the *second chapter* where it is called oscillation.

The oscillation process is needed to search for other copters and if a copter found another one, he should hold this height. Finding another copter in this context means that the copter measures an obstacle with one of its four sonar sensors (angle of 90 degrees between each one) at a distance between 30 and 60 centimeters. Then the copter knows there is something near me and we assume that this is another copter. This is the next basic behavior of the copters which is defined in the *third chapter*.

Now one copter knows what to do alone but because of one copter is not a swarm we extend the process to all four copters in *chapter four*. Generally the same code is running on all four copters except on the decision which sonar sensors should be used to detect obstacles.

So far a random search process is implemented with holding the current height if another copter was found. If an already found copter is lost the random search process starts again. Since this is not a really cooperative behavior we developed a finite state machine to define what needs to be done if a found copter is lost. This finite state machine allows us to implement a real swarm behavior. This means that the copters that have found each other will search together for further copters, on the other hand if a copter gets lost the

remaining group should not break up rather it should search together for the lost one. This finite state machine is described in the *fifth chapter*.

Theoretically everything works now. What the copters do in real and if they converge to a real swarm is explained in *chapter six*.

Finally a conclusion of the whole development process is made in the last *chapter seven*. Furthermore there are mentioned some general problems and possible future work.