Abstract

In this research, in swarm robotics which many robots realize the desired function by cooperating their motions each other, we focus on the formation control which makes many robots to converge to desirable formation from randomly deployed initial position, and address the problem "how can we estimate robots' positions efficiently and accurately when communication loss among robots has occurred?"

In this thesis, we firstly target the control method especially for equilateral triangle lattice as target configuration in formation control. At first, we proposed the evaluation indices to measure the degree of convergence of robots from randomly deployed initial positions to the target equilateral triangle formation, and validate their efficiency.

Next, we focus on the fact that robots converge to target configuration exponentially intended control method in this time, we proposed novel extrapolating method using exponential function to estimate positional information from past states when communications among robots are lost, discussed its mathematical property and estimation accuracy, and validated its efficiency by simulations. Moreover, we improved this extrapolating method using exponential function, and succeeded to improve its estimation accuracy.

Subsequently, at first although we assumed that robots obey first order differential equation in the algorithm which forms equilateral triangle lattice, but we showed that the extrapolating method using exponential function proposed in this time is applicable to the case robots obey second order, …, n-th order differential equation.

key words: swarm robot, formation control, triangle formation, communication loss recovery, exponential extrapolation