Interconnecting Robotic Subsystems in a Network

Javier A. Alcazar and Ephrahim Garcia

Laboratory for Intelligent Machine Systems
Mechanical and Aerospace Engineering
Cornell University
javier.alcazar@cornell.edu

1. Abstract

This paper analyzes how the interconnection of subsystems affects the network dynamics of the overall system's connective stability. Some closed form equations for the magnitude of the interaction between subsystems are obtained to aid in the design of nearest neighbor interconnected subsystems or fully interconnected subsystems.

2. Introduction

Multi robot formation algorithms have been of considerable importance in the control and robotics communities due to their applications in search and rescue missions, air traffic control, automatic highways and military operations such as reconnaissance, surveillance and target acquisition to mention a few. The analysis of connective stability for different subsystem interconnections in robot formations has not been examined, and so, this paper is intended to fill that gap.

In previous work multi robot formations have been accomplished in several different ways. Behavioral-based approaches have been used for robot formations [Balch 1998], [Arkin 1992] and [Kube 1993], but do not include a formal development of the system controls from a stability point of view. Artificial formations have been studied using analogs to animal behavior. Reynolds developed a simple egocentric behavioral model for flocking which is instantiated in each member of the simulated group of birds. The behavior consists of several separate components [Reynolds 1987]. In other studies algorithms for formations have been proposed such as in [Fredslund 2001] and [Fredslund 2002], where each robot keeps a single *friend* at a desired angle