



Research Talks by Visiting Professor

Dr. Andrea Gasparri

Engineering Department, Roma Tre University, Italy

Dr. Gasparri is a young expert with rapidly growing recognition in the emerging area of distributed networked robotics, a field at the intersection of control, robotics, and networking that is currently gaining in importance. Dr. Gasparri will be visiting USC from May 21 - June 30.

June 4, 2013 Multi-Robot Systems: A Control Perspective- Tutorial Part I

June 7, 2013 Multi-Robot Systems: A Control Perspective – Tutorial Part II

June 11, 2013 Swarm Aggregation Algorithms for Multi-Robot Systems

All talks in EEB 248 at 11:00am

Biography: Andrea Gasparri received the Graduate degree (cum laude) in computer science in 2004 and the Ph.D. degree in computer science and automation in 2008, both from the University of Rome Roma Tre, Rome, Italy. He is currently an Assistant Professor for the Engineering Department, University of Rome Roma Tre. His current research interests include mobile robotics, sensor networks, and, more generally, networked multi-agent systems.

Title: Multi-Robot Systems: A Control Perspective (6/4 - Tutorial Part I, 6/7 - Tutorial Part II EEB 248 11:00am)

Abstract: Multi-Robot Systems represent an important research field with a wide variety of topics to be addressed. In recent years a great effort has been made by the research community towards the development of decentralized techniques to provide an adequate level of robustness and flexibility to these systems. This tutorial will provide first a general overview of this research area, focusing on the most important design aspects of a multi-robot system, e.g. control and communication architecture, and illustrating the most important research problems. Then, it will focus on the control aspects of the distributed cooperation problem. In that context, the consensus problem will be first reviewed as a starting point towards the investigation of more refined techniques to achieve spatial aggregation between the robotic units. Furthermore, the connectivity maintenance problem will be introduced, a taxonomy of the approaches available at the state of the art will be derived and some relevant techniques will be described more in detail. Finally, relevant applications in the context of multi-robot systems which rely on the distributed coordination techniques previously introduced will be highlighted.

Title: Swarm Aggregation Algorithms for Multi-Robot Systems (6/11 EEB 248 11:00am)

Abstract: In this talk, a novel decentralized swarm aggregation algorithm for multi-robot systems is proposed. In this framework, the interaction among robots is limited to their visibility neighborhood, i.e., robots that are within the visibility range of each other. Furthermore, to better comply with the hardware/software limitations of mobile robotic platforms, robots actuators are assumed to be saturated. First, a decentralized control law which fulfills these requirements is derived. Successively, a more refined control law also able to i) ensure a collision-free interaction, ii) handle asymmetric saturations with respect to the forward and backward velocity, and iii) integrate an obstacle avoidance is proposed to safely move the swarm within a cluttered environment. A theoretical characterization of the main properties of the proposed swarm aggregation algorithms is provided. Simulations have been carried out to validate the theoretical results. Furthermore, experiments have been performed with a team of low-cost mobile robots to demonstrate the effectiveness of the proposed approach in a real-world environment.