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Key Laboratory of System Control and Information Processing, Ministry of Education

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Graph Theory and Consensus:

Theory and Applications

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Abstract:

Multi robot systems have found a wide range of applications in real life, including Search and Rescue missions and the exploration of unknown and hazardous environments. In recent years, many different approaches have been developed in order to control multi robot systems, mainly inspired by the behavior of social animals such as ants, fishes and birds. The approaches all consider the possibility to develop decentralized controls that allow each agent to act individually while interacting only with a small number of teammates. Due to its intrinsically decentralized nature, one of the most promising approaches to multi robot systems is based on graph theory and consensus algorithm. Starting from basic concepts and definitions related to graphs, the presentation will consider the consensus algorithm applied to connectivity problems and formation keeping for agents moving in cluttered environments. The presentation will conclude with an applicative example where the decentralized algorithms based on graph and consensus theory are applied to the control of Mobile Ad-hoc NETworks (MANETs) used in case of Search and Rescue missions after natural disasters. The redundancy and fault tolerance of this system will be enlightened with simulation examples.

Biography:

Prof. Riccardo Falconi received his Master degree in Computer Science Engineering at the University of Bologna, Italy, and his PhD in Automation and Operative research at Faculty of Engineering, University of Bologna, Italy, under the supervision of the Ministry of Education and Research of Italy. From 2009 to 2011 he was a Post doctoral researcher at the Laboratory of Automation and Robotics of the University of Bologna. In July 2011 he joined the research staff of the Advanced Applications in Mechanical Engineering and Materials Technology Laboratory. In 2010 he was invited researcher at Max Planck Institute for Biological and Cybernetics in Tubingen, Germany, where he worked on the modeling and control of an innovative Unmanned Aerial Vehicle for high maneuverability tasks. In the last years, part of his research was devoted to the application of intelligent and advanced control algorithms and low cost technology to the solution of industrial problems.