

Meeting: 1001, Evanston, Illinois, SS 15A, Special Session on Mathematical Problems in Robotics

1001-93-371 **Abubakr Muhammad*** (abubakr@ece.gatech.edu), School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA 30332. *Coverage, Complexity and Feasibility Issues in Mobile Sensor Networks*. Preliminary report.

This talk concerns various properties of Vietoris-Rips complexes. They arise naturally from various settings in mobile sensor networks and multi-agent robotics, where they are called as "connectivity graphs" or "communication networks". We first explore some geometrical conditions regarding their feasibility by presenting several examples and sufficient conditions. We then study the relationship between the Rips and Nerve complexes arising from the sensing domains of the nodes using the classical theorems from Cech-homology theory. A certain modification to the Vietoris-Rips complex ensures a desired homotopy equivalence and lets us to migrate from a collection of sensor domains to a purely combinatorial object (the Rips complex), without changing the underlying topology. This simplification enables the study of coverage problems for sensor networks in certain domains by using computational tools from homology theory, without any reference to the coordinates of the nodes. This is particularly useful in practical scenarios, where difficulty in the global localization of individual nodes and limited inter-node communication hinders the implementation of a solution that requires precise knowledge of coordinates. (Received August 31, 2004)