An ant colony is a marvel of cooperation and coordinated, purposeful work carried out by simple a(ge)nts with very limited capabilities. Ants do not have GPS systems, have no compasses nor odometers, do not use laser range finders, nor do they have good memories or extraordinary computational resources, and employ no sophisticated long-range sensing or communication equipment. Yet they are ruling the earth, by numbers and by resilience, and by some evolution-developed local response algorithms that rely on pheromone-mediated myopic interactions. The environment becomes a huge, shared resource covered with "chemical memory" signals.

The paradigm of swarm robotics is an attempt to mimic this phenomenal success of nature. In the attempt to analyze the capabilities of colonies of small and limited robots to perform a variety of tasks one encounters formidable mathematical difficulties. The direct problem of analyzing the emergent global behavior that results from a set of rules of local interaction is tractable in a few interesting cases, like for example in gathering and region covering or patrolling missions, The inverse problem of deriving local rules of behavior, based on the ant-like robots' limited sensing and communication capabilities, is far less approachable. Several examples illustrating the mathematical tools available for analyzing the behavior of swarms of myopic agents will be discussed in my presentation.