1108-60-19 **Quan Yuan*** (quanyuan@wayne.edu) and **George Yin**. *Analyzing Convergence and Rates of Convergence of Particle Swarm Optimization Algorithms Using Stochastic Approximation Methods.*

Recently, much progress has been made on particle swarm optimization (PSO). A number of works have been devoted to analyzing the convergence of the underlying algorithms. Nevertheless, in most cases, rather simplified hypotheses are used. For example, it often assumes that the swarm has only one particle. In addition, more often than not, the variables and the points of attraction are assumed to remain constant throughout the optimization process. In reality, such assumptions are often violated. Moreover, there are no rigorous rates of convergence results available to date for the particle swarm, to the best of our knowledge. In this paper, we consider a general form of PSO algorithms, and analyze asymptotic properties of the algorithms using stochastic approximation methods. We introduce four coefficients and rewrite the PSO procedure as a stochastic approximation type iterative algorithm. Then we analyze its convergence using weak convergence method. It is proved that a suitably scaled sequence of swarms converge to the solution of an ordinary differential equation. We also establish certain stability results. Moreover, convergence rates are ascertained by using weak convergence method. A centered and scaled sequence of the estimation errors is shown to have a diffusion limit. (Received November 09, 2014)