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Behavior of the Particle Swarm Optimization Algorithm. Preliminary report.

We present a deterministic convergence analysis of the particle swarm optimization(PSO) algorithm using contraction mapping principles. Our purpose is to understand the dynamics of the algorithm and the behavior of the particle trajectories under various conditions. We noticed that the PSO update equations can be viewed as a sequence of affine mappings in R^K with an offset vector based on current personal best and global best positions. We prove that these mappings are in-fact contraction mappings for certain selections of learning parameters and the sequence converges provided personal best and global best positions converge. Our analysis is more general and removes the stagnation assumptions used in previous analyses. We allow the personal best and global best to have infinitely many positions before converging. An example is provided to elucidate the theoretical findings. Moreover, we prove that the example is also a counter example to some of the claims made in previous studies. Currently our analysis is deterministic but we are working to extend the analysis to include stochastic components in the future. (Received September 24, 2017)