PARTICLE SWARM OPTIMIZATION: A UNIVERSAL OPTIMIZER?

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The main objective of this tutorial will be to answer the question if particle swarm optimization (PSO) can be considered as a universal optimizer. In the context of this tutorial, this means that the PSO can be applied to a wide range of optimization problem types as well as search domain types. The tutorial will start with a very compact overview of the original, basic PSO. Some experience and background on PSO will be assumed. The tutorial will cover a classification of different problem types, and will show how PSO can be applied to solve problems of these types. This part of the tutorial will be organized in the following sections, one for each problem type:

- Continuous-valued versus discrete-valued domains
- Unimodal versus multi-modal landscapes
- Multi-solution problems requiring niching capabilities
- Constrained versus unconstrained problems, also covering boundary constraints
- Multi-objective optimization
- Dynamic environments
- Dynamic Multi-objective optimization
- Optimization with dynamically changing constraints

For each problem type, it will be shown why the standard PSO can not solve these types of problems efficiently. Simple adaptations to the PSO that will allow it to solve each problem type will then be discussed. The focus will be on PSO adaptations that do not violate the foundational principles of PSO. For each of these problem types a small subset of the most successful algorithms will be discussed.