Abstract

In the last few years there has been an increasing interest and development in the field of applying computational intelligence and namely evolutionary algorithms to electrical power systems and other fields that involve a large requirement for data processing related with a large number of variables. This thesis is settled in a way to reduce the processing capability and the number of iterations and there for the time needed to get an acceptable result and a more rapid convergence towards the optimum. For that it will be used “autoencoders” in order to reduce the dimension of the search space in complex optimization problems allowing a more efficient search by meta-heuristic algorithms, producing a reduction in computing time and also an improvement in the quality of results.

In a first stage of this thesis, the basics of Evolutionary Particle Swarm Optimization (EPSO) will be presented, which is a hybrid optimization algorithm, developed on INESC – Porto, which gathers the best qualities of Genetic Algorithm (GA) and Particle Swarm Optimization (PSO).

Also, one will describe a previously developed algorithm that applies the optimization algorithm EPSO to the Hydro-Wind coordination model, upon which this thesis will be developed.

Then, the thesis proposes the application of Fast Artificial Neuronal Network (FANN) as an autoencoder, to Wind – Hydro coordination, resulting in feature extraction, reducing the solution space dimension which will result in a faster obtainment of an acceptable solution when compared to the existing model.

Finally, one proposes a hybrid method, applying the optimization algorithm EPSO and the autoencoder Artificial Neuronal Networks (ANN) to the Wind – Hydro Power model, thus reducing the time taken on the obtainment of an acceptable operation plan that establishes a strategy to operate the system achieving the maximum profit, and the time taken on the discovery of the optimum solution.

The technique is applied in prepared problem examples that highlight the difficulties of the task and the merits of the approach.

Keywords: Evolutionary Programming, Optimum Solution, Evolutionary Particle Swarm Optimization, Hydro-Wind power model, Fast Artificial Neuronal Network.