Optimization of Analysis Sequence for Complex System Design

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ABSTRACT

A complex engineering system can be decomposed into several related and more manageable subsystems. The input, output relations between theses subsystems are very complicated and are non-hierarchic in nature. It is perhaps feasible to arrange the analysis sequence manually while the number of analysis modules is small. The number of possible analysis sequences increases exponentially as the number of modules increases linearly. Therefore, attaining the optimal analysis sequence of a complex system is categorized as a NP Hard problem. Arranging the analysis sequence of a complex system manually is not acceptable, although not impossible. The Hopfield neural network is extensively applied to obtaining an optimal feasible solution in many different applications. Although providing rapid convergence to the solution, the system frequently converges to a local minimum near initial value. Stochastic simulated annealing algorithm is a highly effective means of obtaining an optimal solution capable of preventing the local minimum. This important feature is embedded into a Hopfield neural network to derive a new technique, i.e. annealing neural network. This paper proposes a new idea of applying annealing neural network to optimal sequencing of complex system. Energy functions for Hopfield network and annealing network are derived. Comparisons are made among Hopfield network, annealing network and genetic algorithm. Results show that annealing network outperforms Hopfield network and genetic algorithm in robustness while Genetic algorithm possesses the highest efficiency among these methods.

Keywords : complex system, neural network, simulated annealing-viialgorithm, annealing network, genetic algorithm.

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