Abstract

Optimization is the process of finding the optimum/best solution under certain parameters defined in the problem. Those parameters are like design variables, the type of objective function, the number of decision variables and the constraints. In general optimization problems are divided into two classes viz. Constrained and unconstrained optimization problems. The design variables may be continuous, discrete or mixed type. The function may be linear/non linear, convex/non convex, discrete/continuous type. Therefore, the design of optimization strategy/techniques to handle such problems is an essential task for finding a robust solution to the problem. In the other hand, Optimization algorithms can be broadly divided into two categories viz. Deterministic methods and Probabilistic methods. Deterministic methods/Traditional methods can be applied over continuous functions. The methods use the gradient information of the function and also need smaller function evaluation. But, probabilistic methods can work with discrete as well as continuous variables and find the global optimum in presence of several local optima. Now-a-days the invention of high speed digital computers has grown interest among the researchers to develop robust evolutionary computation technique in tackling the complex optimization problems. Among the recent evolutionary techniques, Genetic Algorithm (GA) is the most popular evolutionary algorithm, developed by John Holland in 1975. Later, several Bio-inspired techniques also came into existence. Among them the Bacterial Foraging Optimization (BFO) is one of the popular and efficient methods. According to No free lunch theorem, there is no single optimization technique which can solve all sorts of problem. So, there is a growing interest among the researchers to design hybrid evolutionary technique to solve such problems.

In this thesis an attempt has been made to design such a hybrid evolutionary technique where GA has been hybridized with Chemo tactic step of BFO. The algorithm thus named as Chemo-Inspired Genetic Algorithm (CGA). Initially the

CGA has been designed to solve unconstrained optimization problem. Later it has been extended to solve constrained optimization problems and further it is renamed as Chemo-inspired Genetic Algorithm for Constrained optimization (CGAC). The last "C" stands for handling the constrained problems. The robustness of the both CGA and CGAC has been realized over a wide set of complex benchmarking functions. Both the algorithms have also been applied to solve some real life unconstrained as well as constrained optimization problems.

The thesis is broadly divided into 7 Chapters. Chapter 1 is introductory in nature. In Chapter 2, CGA is being applied to solve a set of typical unconstrained benchmark functions. The superiority of CGA is concluded over the individual GA and GA-BFO hybridization. A wide range of unconstrained test functions have been solved in Chapter 3. CGA is shown better than quadratic approximation hybridized GA. In addition, the investigation of best suit parameter setting has been carried out in this Chapter. In Chapter 4, the CGA algorithm has been applied to solve an unconstrained real life problem namely Model Order Reduction (MOR) problem for linear continuous time invariant Single Input & Single Output (SISO) system. Chapter 5 is the extension of CGA to solve constrained optimization problems and named as CGAC. In Chapter 6, CGAC has been applied to solve non-convex Economic Load Dispatch (ELD) problems. The conclusion of the thesis is reported in Chapter 7.