NEW OPTIMIZATION TECHNIQUES IN ENGINEERING

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PREFACE

Presently, general-purpose optimization techniques such as Simulated Annealing, and Genetic Algorithms, have become standard optimization techniques. These optimization techniques commence with a single solution and then find the best from several moves made, and generally, past history is not carried forward into the present. Many researchers agree that firstly, having a population of initial solutions increases the possibility of converging to an optimum solution, and secondly, updating the current information of the search strategy from previous history is a natural tendency. Accordingly, attempts have been made by researchers to restructure these standard optimization techniques in order to achieve the two goals mentioned.

To achieve these two goals, researchers have made concerted efforts in the last one-decade in order to invent novel optimization techniques for solving real life problems, which have the attributes of memory update and population-based search solutions. This book describes these novel optimization techniques, which in most cases outperform their counterpart standard optimization techniques in many application areas. Despite these already promising results, these novel optimization techniques are still in their infancy and can most probably be improved. To date, researchers are still carrying out studies on sound theoretical basis and analysis to determine why some of these novel optimization techniques converge so well compared to their counterpart standard optimization techniques.

Interestingly, most books that have reported the applications and results of these novel optimization techniques have done so without sufficiently considering practical problems in the different engineering disciplines. This book, *New Optimization Techniques in Engineering* has three main objectives: (i) to discuss in the clearest way possible, these novel optimization techniques, (ii) to apply these novel optimization techniques in the conventional engineering disciplines, and (iii) to suggest and incorporate the improvements in these novel optimization techniques that are feasible as and when it is possible in the application areas chosen.

To achieve the first objective, Part I containing seven chapters have been written by the inventors of these novel optimization techniques or experts who have done considerable work in the areas (Memetic Algorithm, Scatter Search, Ant Colony Optimization, Differential Evolution, Self-Organizing Migrating Algorithm, Particle Swarm Optimization). Genetic Algorithm has been included for completeness since it is the progenitor of Memetic Algorithm. The contributor for Genetic Algorithm has been chosen, not as the inventor, but due to his expertise and contributions in Genetic Algorithms. To achieve the second objective, Part II contains several chapters in which researchers have applied these novel optimization techniques to different Engineering disciplines such as Chemical/Metallurgical Engineering, Civil/Environmental Engineering/Interdisciplinary, Electrical/Electronics Engineering, Manufacturing/Industrial Engineering, and Mechanical/Aeronautical Engineering. Firstly, the Engineering background is sufficiently given concerning the problem-domain, and then a novel optimization technique is applied. Consequently, Part II makes it easy for engineers and scientists to understand the link between theory and application of a particular novel optimization technique. To achieve the third objective, the possible improvements in these novel optimization techniques are identified, suggested and applied to some of the engineering problems successfully. Part III discusses newer areas, which are considered as extended frontiers.

The text serves as an instructional material for upper division undergraduates, entry-level graduate student, and a resource material for practicing engineers, research scientists, operations researchers, computer scientists, applied mathematicians, and management scientists. Those to purchase the book include upper division undergraduates or entry-level graduate students, academics, professionals and researchers of disciplines listed above, and libraries.

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