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R. Venkata Rao
Jan Taler *Editors*

Advanced Engineering Optimization Through Intelligent Techniques

Select Proceedings of AEOTIT 2018

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Preface

Optimization may be defined as finding the solution to a problem where it is necessary to maximize or minimize a single or set of objective functions within a domain which contains the acceptable values of variables while some restrictions are to be satisfied. There might be a large number of sets of variables in the domain that maximize or minimize the objective function(s) while satisfying the described restrictions. They are called as the acceptable solutions, and the solution which is the best among them is called the optimum solution to the problem. An objective function expresses the main aim of the model which is to be either minimized or maximized. For example, in a manufacturing process, the aim may be to maximize the profit or minimize the cost. In designing a structure, the aim may be to maximize the strength or minimize the deflection or a combination of many objectives. The use of optimization techniques helps the engineers in improving the system's performance, utilization, reliability, and cost.

An international conference on "Advanced Engineering Optimization Through Intelligent Techniques (AEOTIT 2018)" was held during August 03–05, 2018, at Sardar Vallabhbhai National Institute of Technology, Surat, India. The objective of the conference was to bring together experts from academic institutions, industries, and research organizations and professional engineers for sharing of knowledge, expertise, and experience in the emerging trends related to advanced engineering optimization techniques and their applications. There had been an overwhelming response to the call for papers. More than 200 research papers were received from the researchers and academicians of the leading institutes and organizations. However, only 76 good-quality papers have been selected based on the recommendations of the reviewers for inclusion in the proceedings. These papers have covered various intelligent optimization techniques including meta-heuristics, neural networks, decision-making methods, and statistical tools.

We are extremely thankful to the authors of the papers, national and international advisory committee members, session chairmen, faculty and staff members of SVNIT, Surat, and CUT, Cracow, and student volunteers for their cooperation and

help. We are grateful to the team members of Springer Nature for their support and help in producing these proceedings. We are confident that these proceedings would benefit the optimization research community.

Surat, India — R. Venkata Rao
Kraków, Poland — Jan Taler

Contents

Solution of Non-convex Economic Dispatch Problems by Water Cycle Optimization

Vishal Chaudhary, Hari Mohan Dubey and Manjaree Pandit

Abstract This paper presents water cycle algorithm (WCA) for solving optimization of economic dispatch problems of modern power system. It is a newly developed algorithm which mimics the concept behind natural hydrological process and flow of water through rivers and streams to the ocean. Performance of WCA is tested on small- and medium-scale standard test cases having non-convex fuel cost characteristics of six and 13 thermal generating units. Comparative analysis is carried out to validate applicability and superiority over other reported methods. The new approach is found to provide optimal results for tested complex constrained optimization problems.

Keywords Water cycle optimization · Water stream · River · Ocean · Non-convex · Transmission loss

Nomenclature

a_i, b_i, c_i, e_i, f_i	Cost coefficients
$\mathcal{P}_{\mathrm{D}}$	Power demand
$\mathcal{B}_{ij}, \mathcal{B}_{i0}, \mathcal{B}_{00}$	Loss coefficients
NP	Total Population size (rain drop)
D	Dimension of problem
N	Total no. of river + 1 (one sea)
$N_{\mathrm{R\_total}}$	Total no. of river
$N_{\mathrm{S\_total}}$	Total no. of water stream

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