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A MODIFIED PARTICLE SWARM OPTIMIZATION WITH FEASIBILITY-BASED RULES FOR MIXED-VARIABLE OPTIMIZATION PROBLEMS

Chaoli Sun[1], Jianchao Zeng[1] and Jeng-Shyang Pan[2,3]

[1]Complex System and Computational Intelligence Laboratory
Taiyuan University of Science and Technology
No. 66, Waliu Road, Wanbolin District, Taiyuan 030024, P. R. China
clsun1225@163.com; zengjianchao@263.net

[2]Shenzhen Graduate School
Harbin Institute of Technology
Nanshan District, Shenzhen 518055, P. R. China

[3]Department of Electronic Engineering
National Kaohsiung University of Applied Sciences
Chien Kung Campus 415, Chien Kung Road, Kaohsiung 807, Taiwan
jspan@cc.kuas.edu.tw

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Abstract. *A modified particle swarm optimization (MPSO) is introduced for the optimization of mixed-variable problems. The constraint-handling mechanism is based on the feasibility rules, with no additional penalty parameters and no requirement to be in the feasible region at all times. The average velocity of the swarm is proposed as a disturbance to expand the search range for each particle, designed to overcome the premature convergence. The values of different kinds of variables are firstly proposed to be achieved according to their respective flying velocities. The performance of MPSO is evaluated against real-world mixed-variable optimization problems, and experimental results show that the proposed algorithm is simple, generic, easy-to-implement and be highly competitive compared with existing algorithms.*
Keywords: Modified particle swarm optimization, Mixed-variable optimization problems, The constraint-handling mechanism, Feasibility rules, Reversed average velocity

1. **Introduction.** Design variables in optimization problems are commonly supposed to be continuous. However, many real-world problems often involve discrete, integer and zero-one variables as well as continuous ones. For example, the size of standard diametric pitch of a gear, the shell thickness and spherical heads' thickness of a pressure vessel are often defined as discrete variables. Integer variables are usually used to express a number of identical elements in the mechanical design. Zero-one variables, also known as binary variables, are usually required in the formulation of design problems with alternative options such as the switch selection. Obviously, the value of a zero-one variable is either 0 or 1, so this kind of variable can also be attributed to integer or discrete ones. Problems which contain integer, discrete, zero-one and continuous variables are called mixed-variable optimization problems (MVOP). Generally, a mixed-variable optimization