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TWO EFFICIENT REAL-CODED GENETIC ALGORITHMS FOR REAL PARAMETER OPTIMIZATION

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Abstract. *This paper presents an efficient generation alternation model for real-coded genetic algorithm called rc-CGA. The most important characteristic of the proposed rc-CGA model is the implicit self-adaptive feature in its crossover and mutation mechanism. By applying two crossover operators (BLX-α and UNDX crossover) in conjunction with Non-Uniform mutation to rc-CGA, respectively, we define two new real-coded genetic algorithms (rc-CGA+BLX+NUM and rc-CGA+UNDX+NUM). The proposed two real-coded genetic algorithms are compared with five existing real-coded genetic algorithms (MMG+BLX, MMG+UNDX, MMG+SPX, SGA+LX-NUM and JGG+REX^{star}) by simulating a set of 19 test problems available in the global optimization literature. The simulation results show that the rc-CGA is very efficient and that the rc-CGA+BLX+NUM performs quite well and outperforms other real-coded genetic algorithms for real-parameter optimization.*

Keywords: Genetic algorithm, Function optimization, Real-coded

1. **Introduction.** Real parameter optimization problems having local as well as global optima are of high importance for engineering, science and technology. Mostly, users are interested in determining the global minima. However, it is difficult to determine the global minima rather than local minima. For finding near global minima, many stochastic optimization techniques like evolutionary algorithms, simulated annealing, etc. have been developed, which rely heavily on computational power. Among these, genetic algorithm (GA) [1] is found to be very promising global optimizer. The popularity of this method is based on simply solving multidimensional and multimodal optimization problems without requiring any additional information such as the gradient of an objective function. Although the origin of this method proposed binary number for encoding, over the past ten years, there have been a surge of studies and applications related to real-coded genetic algorithms (RCGAs) for continuing space problem [2-14]. In RCGAs, crossover has always been considered to be the fundamental search operator. A lot of effort has been put into the development of sophisticated real-coded crossover operators to improve the performances of the RCGAs for real-parameter optimization. A serial of crossover operators have been presented like Heuristic crossover [2], Flat crossover [3], Arithmetical crossover [4], Blend crossover (BLX-α) [5], Simulated binary crossover (SBX) [6], Unimodal normal distribution crossover (UNDX) [7] and its extension UNDX-m [8], Simplex crossover (SPX) [9], Parent centric crossover (PCX) [10], Laplace crossover [11] and Real-coded ensemble crossover(REX^{star}) [12].

Besides the recombination operator, researchers have also realized the importance of the genetic algorithm model for the real-parameter optimization. Many generation alternation models have been proposed, for instance, SGA [1], IGS [17], SS [18], CHC [19], ER