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CONSTRUCTING A T-WAY INTERACTION TEST SUITE USING THE PARTICLE SWARM OPTIMIZATION APPROACH

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Abstract. *This paper presents the design and implementation of a new t-way test generation strategy, known as the Particle Swarm Test Generator (PSTG). Complementing the existing work on t-way testing strategies, PSTG serves as our research vehicle to investigate the applicability of Particle Swarm Optimization for t-way test data generation. The experimental results demonstrate that PSTG is capable of outperforming some of the existing strategies as far as the test size is concerned. Additionally, the evaluation also indicates the effectiveness of PSTG in generating an efficient test suite for testing consideration.*
Keywords: Testing, *t*-way testing, Interaction testing, Artificial intelligence, Particle swarm optimization

1. **Introduction.** In the last 20 years, software has grown tremendously in terms of size (i.e., line of codes (LOCs)) and functionality. In the old days, there was hardly any commercial software with more than 15K LOCs [1,2]. Nowadays, such a phenomenon has changed completely. It is now common to have commercial software that has more than a million LOCs [3]. Such a significant growth has a strong influence as far as testing and quality assurances are concerned.

With the increase in LOCs, more often unwanted interactions among software systems, hardware components and operating systems are to be expected, rendering increased possibility of faults. While traditional static and dynamic testing techniques are useful for fault detection and prevention, they may not be sufficient to tackle faults due to interaction [4]. Addressing this issue, many *t*-way strategies (whereby *t* indicates the interaction strength) have been developed in the literature in the last 15 years. Indeed, *t*-way strategies help to search and generate a set of tests, which forms a complete suite that covers the required interaction strength at least once from a typically large space of possible test values.

Viewing as a combinatorial optimization problem, searching for the optimal set of test cases is NP hard; i.e., an increase in the parameter size causes an exponential increase in the computational time as well as in the degree of problem complexity [5,6]. In order to solve this NP hard problem, many artificial intelligence-based strategies have been developed in order to find near optimal solutions within polynomial time [6-9].