

## A Multi-Objective Evolutionary Algorithm for Optimization of Road Design Using A Random Key Genetic Algorithm

J. Magalhães-Mendes<sup>1</sup>

<sup>1</sup> Instituto Politécnico do Porto (P.PORTO)  
Instituto Superior de Engenharia do Porto (ISEP)  
Rua Dr. António Bernardino de Almeida, 431, 4249-015 Porto, Portugal  
E-mail: jjm@isep.ipp.pt  
URL: ISEP.IPP.PT

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abstract – In today's market-driven economy, the ability to minimize the time and/or cost of a project could determine the profitability and even the survival of a construction company. The increasing acceptance of alternative tenders and different project delivery systems, such as design and build, management contracting, build-operate-transfer, partnering, etc., allows greater flexibility in construction duration. This also means that both construction time and cost should be considered concomitantly at the estimation and planning and stages.

Multi-objective formulations are realistic models for many complex engineering optimization problems. Customized genetic algorithms have been demonstrated to be particularly effective to determine excellent solutions to these problems.

The objective of this paper is to present the development of an advanced multi-objective optimization model that supports minimizing construction time and cost, while maximizing its quality.

In many real-life problems [1], objectives under consideration conflict with each other, and optimizing a particular solution with respect to a single objective can result in unacceptable results with respect to the other objectives. A reasonable solution to a multi-objective problem is to investigate a set of solutions, each of which satisfies the objectives at an acceptable level without being dominated by any other solution.

In this paper is presented a multi-objective evolutionary algorithm (an area called multi-criteria of decision making [2]) using a random key genetic algorithm for optimization of road design. An application to road design alternatives describing genetic algorithms developed specifically for these problems using multiple objectives is described. They differ from traditional genetic algorithms by using specialized fitness functions, introducing methods to promote solution diversity.

Each chromosome represents a solution to the problem and it is encoded as a vector of random keys (random numbers). Each solution encoded as initial chromosome (first level) is made of  $mn+n$  genes where  $n$  is the number of activities and  $m$  is the number of execution modes [3].

An application example [1] is analyzed to illustrate the use of the model and demonstrate its capabilities on generating tradeoffs among construction time, cost, and quality with good results.

## REFERENCES

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