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SIMULATION-OPTIMIZATION BY SIMILARITY: FIRST IDEAS

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ABSTRACT

Optimization by similarity is a concept under development in our research group in which a function with known optimality characteristics is matched against experimental data to determine the region where optimality could occur. If instead of using experimental data, one uses simulated data generated with an experimental design, a simulation-optimization by similarity technique is a feasible possibility. This work explores these first ideas with designs of experiments ranging from 2 independent variables to 50 independent variables.

1 INTRODUCTION

The problem of optimization by similarity entails matching one function with well-established optimality properties with another function that is not well characterized in terms of optimality. The aim is to find the region where the uncharacterized function resembles the well-characterized one. This aim, if fulfilled, will reveal areas of potential optimality that were previously unknown.

2 PROCEDURE

The concept can be generalized to matching one function with well-established properties of interest - besides optimality- to another that is uncharacterized in such terms. Optimization by similarity helps to define a region of similarity delimited by a Window of Maximum Similarity (WMS). Basically, the WMS represents a region of interest where a collection of data might resemble a function with optimality properties. The concept is schematically shown in Figure 1.

This work attempts to import these ideas to develop the concept of simulation-optimization by similarity. The intended approach will make use of our group's capability on experimental designs for tens of variables and optimization by similarity. It is believed that this combination will result a strategy similar to that described in (Méndez-Vázquez et al. 2014), which is essentially an iterative optimization scheme with an exploration guided by experimental design and its coordinated used with a multi-starting point driven local optimization, as shown in Figure 2.

When comparing this idea to other well-known simulation optimization schemes such as Particle Swarm Optimization (PSO) and Cross Entropy (CE), an immediate apparent difference is the generation of an initial enumeration of solutions. PSO, as described in (Kennedy and Eberhart 1995, Zhan et al. 2011,), and CE, as described in (Rubinstein 1999, He et al. 2010), both use specific random distributions to initially generate various numbers of solutions. The number of simulations resulting from each scheme will certainly be an important discriminant when comparing these ideas. The method described in (Méndez-Vázquez et al. 2014), have been shown to keep the number of simulations while arriving to competitive solutions. This is partly due to the use of an initial design of experiments and the fact that the optimization is carried out in metamodels first and not directly in the simulation model. This behavior is expected to hold in Simulation-Optimization by Similarity.

3 CONCLUSIONS

This work attempts to introduce the concept of simulation optimization by similarity. The application will be geared towards the analysis of tens of variables simultaneously capitalizing on experimental designs especially designed to this end, as well as a well-tested iterative optimization scheme developed by our research group.

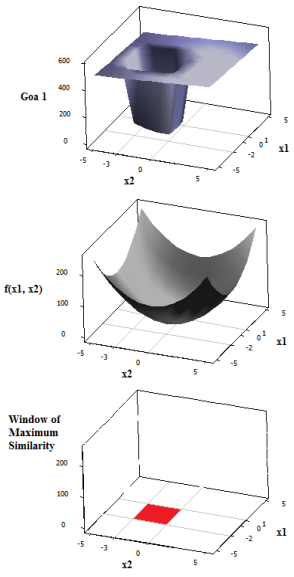

Figure 1: Optimization by Similarity.

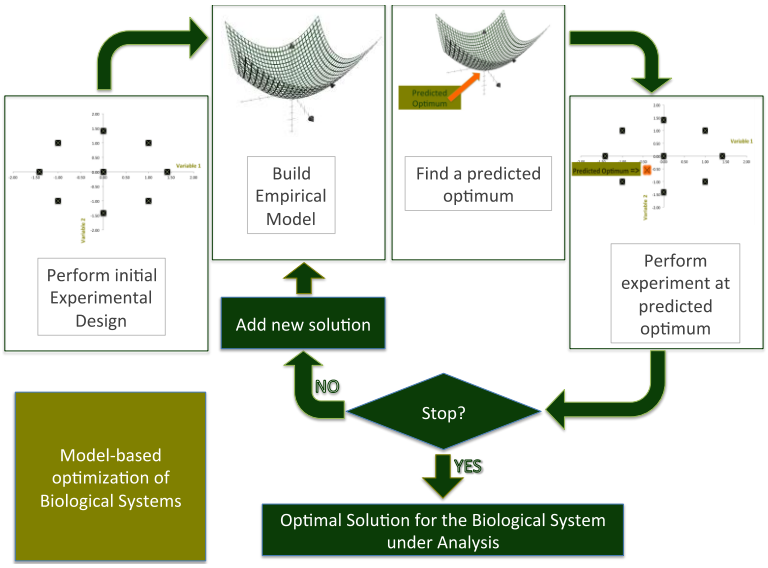

Figure 2: Simulation optimization scheme.

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