TÉCNICO LISBOA

Optimization in Architecture

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Thesis to obtain the Master of Science Degree in

Information Systems and Computer Engineering

Supervisor: Prof. António Menezes Leitão

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Publications

The development of this thesis resulted in several scientific contributions exploring different perspectives of optimization problems:

1. Caetano, I., Ilunga, G., **Belém, C.**, Aguiar, R., Feist, S., Bastos, F., and Leitão, A. (2018). Case Studies on the Integration of Algorithmic Design Processes in Traditional Design Workflows. Proceedings of the 23rd International Conference of the Association for CAADRIA, 1(Giedion 1941), 111–120.

2. **Belém, C.**, and Leitão, A. (2018). From Design to Optimized Design An algorithmic-based approach. Proceedings of the 36th eCAADe Conference - Volume 2, Lodz University of Technology, Poland, 549-558

Abstract

Keywords

Algorithmic Design; Black-Box Optimization; Machine Learning; Surrogate-based Modelling.

Resumo

Palavras Chave

Design Algorítmico; Otimização de caixa-preta; Modelos baseados em aproximações; Aprendizagem Máquina.

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Introduction

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1.1 From design to Optimized design

1.1.1 Building Performance Simulation

1.1.2 Algorithmic Design

1.1.3 Algorithmic Analysis

1.1.4 Architectural Optimization Workflow

1.2 Goals

1.3 Organization of the Document

This thesis is is organized as follows: Chapter 1 interdum vel, tristique ac, condimentum non, tellus. In chapter 2 curabitur nulla purus, feugiat id, elementum in, lobortis quis, pede. In chapter 3 consequat ligula nec tortor. Integer eget sem. Ut vitae enim eu est vehicula gravida. Chapter 4 morbi egestas, urna non consequat tempus, nunc arcu mollis enim, eu aliquam erat nulla non nibh in **??**. Chapter 5 suspendisse dolor nisl, ultrices at, eleifend vel, consequat at, dolor.

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2.1 Single-Objective Optimization

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2.1.1 Derivative-Free Optimization

2.1.2 Optimization Tools in Architecture

2.1.2.A Galapagos

2.1.2.B Goat

2.2 Multi-Objective Optimization

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2.2.1 Experimental Approach

2.2.2 Priori Articulation Approach

2.2.3 Pareto-Based Approach

2.2.4 Metrics for Multi-Objective Optimization

2.2.5 Optimization Tools in Architecture

2.2.5.A Octopus

2.2.5.B Opossum

2.2.5.C Optimo

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3.1 Architecture Overview

3.2 Architecture Design Requirements

3.2.1 Problem Modelling

3.2.2 Simple Solver

3.2.3 Meta Solver

3.3 Architecture Design Implementation

3.3.1 Problem Modelling

3.3.2 Simple Solver

3.3.3 Meta Solver

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- Relembrar o objectivo do trabalho e dizer como o vamos avaliar de um modo geral introduzindo os proximos subcapitulos.

4.1 Qualitative Evaluation

- Number and Heterogeneity of Available algorithms - Differences / Benefits / Disadvantages when compared to Grasshopper's frameworks

4.2 Quantitative of Applications

- Dizer que de um modo geral começámos de forma incremental por considerar problemas single-objective, nomeadamente a casa da ericeira, que remonta a primeira publicação. Depois evoluimos para a avaliação bi-objetivo de dois casos de estudo reais - Pavilhão Preto para exposições e de uma arc-shaped space frame.

- Comentar a facilidade c/ que alguém que já tem um programa AD consegue acopolar optimização a AD.

4.2.1 Ericeira House: Solarium

4.2.2 Black Pavilion: Arts Exhibit

4.2.2.A Skylights Optimization

4.2.2.B Arc-shaped Space Frame Optimization

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Rui Cruz
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5.1 Conclusions

5.2 System Limitations and Future Work

5.2.1 Optimization Algorithms

5.2.2 ML models

5.2.3 Constrained Optimization

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