Design as Exploration:

Multi-objective and Multi-disciplinary Design Exploration and Optimization of Indoor Sports Buildings

**Keywords:** computational design, performance-based design, design exploration, multi-objective optimization, multi-disciplinary optimization, indoor sports building

Architectural Engineering + Technology Department (Chair Design Informatics)

**Area of Research:** Computation & Performance

---

**Research Summary:**

My PhD research, in collaboration with Arup Amsterdam and ESTECO, aims at developing a performance-based design approach for the conceptual design of indoor sports buildings. By utilizing multi-objective and multi-disciplinary design exploration and optimization techniques, the proposed approach is expected to improve multiple building performances simultaneously, including energy, daylight and structural performance aspects; and support the trade-off decision-making. However, in the conceptual building design, the appropriateness of the optimization problem formulation (OPF) is seldom brought into discussion. Thus, its importance is often overlooked. In response, this research emphasizes the importance of the OPF by focusing on the utility of iterative optimization problem re-formulation. The hypothesis of this research is that a posteriori knowledge extracted from a board design exploration is helpful to re-formulate a proper design optimization problem and hence obtain meaningful optimization results.

**Research Methodology:**

This research is structured in three phases, i.e. Introduction and state of the art; Model development, implementation and verification; Conclusion. In the first phase, preliminary literature review is carried out in order to gather enough background information on the main research problems, thus research objectives and questions are formulated. In the second phase, the model is developed iteratively and verified through several case studies. Finally, the last phase summarizes main findings and limitations of this research, states main contributions, and identifies future research directions.

---

**Main Question:**

How computational design exploration can help the optimization problem (re)formulation and hence obtain meaningful optimization results?

**Deliverables:**

As TUDelft affiliated, seven peer-reviewed conference papers were published in 2015-2016. Two journal papers are on-going.
Key Publications:


Link(s)

http://designinformatics.bk.tudelft.nl

Updated: November 3, 2016