Interactive Layout Design Optimization

An interactive optimization tool for architectural floorplan layout design.

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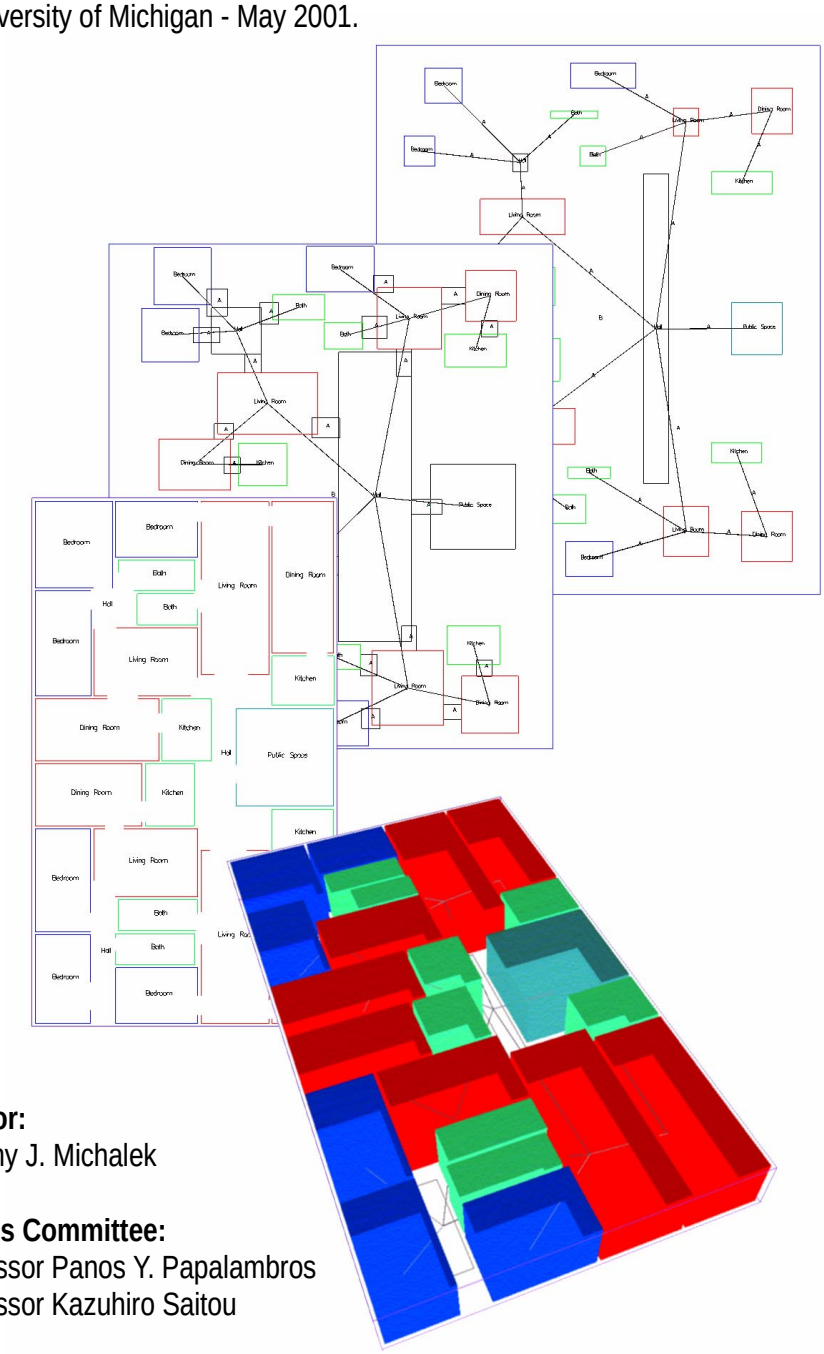


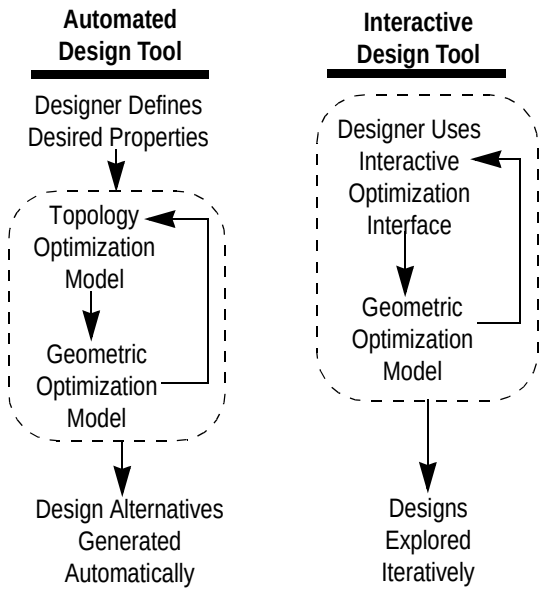
Author:
Jeremy J. Michalek

Thesis Committee:
Professor Panos Y. Papalambros
Professor Kazuhiro Saitou

ABSTRACT

Many areas of design involve both quantifiable and subjective goals, preferences, and constraints. Subjective aspects of design are typically ignored in optimization models because they are difficult to model with mathematics; however, they are extremely important in areas such as product design and architectural design. The objectives of this thesis are (1) to formulate quantifiable aspects of architectural floorplan layout design using computational optimization algorithms, (2) to provide a method for integrating mathematical optimization with human decision making, and (3) to develop the use of optimization techniques as a tool to aid early conceptual design. Two design tools have been developed: an *automated tool* and an *interactive tool*.

The *automated tool* uses a decomposition strategy to separate topological decisions (discrete design decisions) from purely geometric decisions (sizing and placement). The designer specifies desired design characteristics of the building, and the program automatically generates a population of feasible, goal-directed design alternatives.



The *interactive tool* uses an object oriented representation with an interface that allows the designer to interact with the building layout optimization problem. Using the interactive tool, the designer can refine the problem definition on-the-fly and quickly explore solution alternatives and trade-offs while receiving both visual and computational feedback. By interacting with the optimization process, the designer can guide global search and take unmodeled preferences into account. This interactive approach is a novel use of optimization methods as an exploratory sketching tool for the early conceptual design phase.