

GEOMETRIC DESIGN BY INTERACTIVE AND EVOLUTIONARY DESIGN METHODS

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Evolutionary design is a new branch of science that seeks to use meta-heuristic optimization techniques in computer-aided-design. Evolutionary design aims to design smart industrial tools and smart home-appliances, based on the effective variables for them. Geometric design is the issue that can be used in the design of most of these tools. Identifying the effective variables and representing them in the related evolutionary process is one of the major challenges in this field. In this research work, in order to overcome this challenge, we propose using evolutionary levels. The design passes through the levels while keeping to get feedback and guidelines from the user. Passing via these levels is accomplished in the direction of increasing the aesthetic criteria. At each level, we add new components to the design or develop a new design from the design obtained in the previous level. In this regard, three evolutionary levels are proposed. At each level some evolution in the design is gained by providing genetic algorithm processes and representations via defined genes on that level. To initialize the genes and the mutation and crossover operators, we have invented an innovative probability function. Passing through the levels is accomplished according to the aesthetic score given by the user. We implemented the components of the proposed approach in a computer program and run it on a microcomputer along with two interacting users. In order to evaluate the performance of the proposed method, we developed one hundred designs at each level by applying two interacting users. The experimental results show that an average of ten selections in an average of three minutes was adequate to complete a design. In order to develop the same designs by using ordinary CAD tools it would take about ten times more time to complete. In the whole, this research implies that using the proposed method could lead to development of better designs in much less time. This testifies the fact that evolutionary design can be used successfully in developing designs for industrial tools and smart home-appliances.

Key words: Computational Design, Computer-Aided-Design, Evolutionary Art System, Machine Beauty Analysis, Meta-heuristic optimization

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