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Multi-Objective Shape Optimization in Generative Design: Art Deco Double Clip Brooch Jewelry Design

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Abstract. This paper proposes multi-objective optimization generative design (MOOGD) system for generating shapes and optimizing two design objectives. The framework of this paper covers parametric modeling of the product shape configuration using Grasshopper plug-in in Rhinoceros software as well as multi-objective optimization developed using Octopus plug-in on Grasshopper. This framework is applied onto the case study of Art Deco double clip brooch jewelry design. The main goals of the study are to design and to optimize shapes of the double clip brooch in two objectives. The first objective is to apply golden ratio to the generating shapes. The second one is to minimize the use of metal referring to weight of the brooch. In the system, MOOGD finally generates a Pareto front to show the optimal solutions, which artists or designers could further use in conceptual product design process. The illustration of the proposed system is provided in this paper.

Keywords: Generative design; Multi-objective genetic algorithm; Multi-objective optimization; Pareto-optimal front; Art deco double clip brooch.

1 Introduction

Product design does not dealing with only a single objective problem but it is over than one, which can be considered as multi-objective problems. Product design process is complicated and requires problem solving and decision making techniques. Designers spend a lot of time to optimize various factors during designing a product.

Interactive evolutionary computation (IEC) is a method that based on subjective human evaluation. This method becomes important in product design problems because human designers are able to express emotion, preference or feeling onto the generated designs. This paper aims to develop multi-objective optimization algorithm to be used in generative design system with the case study of Art Deco double clip brooch jewelry design.