

# Development of Hybrid Memetic Algorithm and General Regression Neural Network for Generating Iterated Function System Fractals in Jewelry Design Applications

Somlak Wannarumon Kiewarova<sup>(✉)</sup>

iD3 - Industrial Design, Decision and Development Research Unit,  
Department of Industrial Engineering, Faculty of Engineering,  
Naresuan University, Phitsanulok 65000, Thailand  
somlakw@nu.ac.th

**Abstract.** This paper proposes a hybrid memetic algorithm and a general regression neural network for generating decorative elements. This tool is aimed to be used in jewelry design applications. Local search used is the greedy hill-climbing algorithm. Decorative elements are represented using iterated function systems (IFS) fractals. The aesthetic evaluation used in the design system is modeled using a general regression neural network with multiple perception feed-forward back propagation network to evaluate aesthetics of generated decorative elements. Although this paper demonstrates the application in jewelry design, the proposed algorithm is applicable to other product designs. The results of this study were compared to the results obtained with a genetic algorithm. This comparison implies that the proposed memetic algorithm can obtain better fitness and more variety, but requires larger amount of computational time than the genetic algorithm. The results prove that the proposed algorithm can be applied in design applications.

**Keywords:** Memetic algorithm · Decorative element · Jewelry design · Iterated function system · Fractal · General regression neural networks · Local search

## 1 Introduction

In conceptual design stage, designers commonly handle the activities such as generating and recording ideas, deciding to continue to generate more ideas, or exploring more possibilities of some existing favorite ideas [1]. Unfortunately, the available CAD packages are not suitable for use at this stage.

In jewelry design, decorative elements are used as a part of creating jewelry items. Jewelry designers, in conceptual design, usually cope with creating design elements, generating decorative elements, and spatially arranging them to form the design patterns.

Generative Design (GD) system is a computer-based tool, which has characteristics and capabilities to be used for supporting designers in design exploration and design

จำเนาะลัคค้อช  
