

Using Optimal Golden-Fractal Geometrical Shapes to Generate Sustainable and Healthy Interior Environment

Dr. Doaa Ismail Ismail Attia

Assistant professor of Interior Design and Furniture, Faculty of applied Arts, Benha University.

Abstract:

Nowadays, the importance of the shapes existence in interior design and furniture is not only for aesthetic interest, but for the functional, light weight structural and environmental adaptability, comfort of the human wellbeing and sustainability. For long time, the interior designer was inspired by Euclidean geometrical shapes (e.g. triangle, square, and polyhedral), that made the interior design and furniture rigid, non- adaptive and inefficient design with waste of materials. The evolution in computerized design technologies have permitted designers to overcome the limits imposed by Euclidean regular geometry as well as Euclidean shapes and replaced it with the Fractal geometry (non-Euclidean geometry). The fractal geometry is applied to create new kinds of irregular shapes of optimum structures and thus provides high level of force with minimum used mass through the design systems.

The researcher proposed three new simple models to obtain golden fractal “light-weight, high-strength” structure design, that can be used in interior design and furniture applications. **The first model:** two new golden fractal self -symmetry binary trees with symmetry angle =45° and angle=90°, based on using the golden rectangle shape. **The second model:** new hybrid golden fractal shape, consist of two golden pentagon joined together with golden triangles, based on using the golden ratio relation $\varphi^n = \varphi^{n-1} + \varphi^{n-2}$. **The third model:** an optimal golden fractal shapes based on using a mathematical prediction and geometrical analysis technique to obtain a finite mid-range interval $(1,5+\epsilon, 1,5-\epsilon)$ where ϵ is a positive sufficiently small value for optimal fractal dimension. These three models used fractal geometry hierarchical self-similar arranging property and a four-steps computer IFS iterative code to maintain high strength and light weight optimal golden fractal structure design. The researcher used the golden geometrical shape as an initial shape in the iterative process because it emits positive energy, create balance in the interior environment and give wellbeing to human health.

Some of the advantages of using optimal golden fractal “light-weight, high-strength” structure design in interior design and furniture are: being of light weight, therefore, minimize the amount of used materials, the space arrangement becomes quick and easy, thus, changing the static interior space into dynamic. It encourages adaptability and flexibility in the environment. Since, the structure is being of high strength, it can stand the continuous and prolonged duration of functional usage. It brings aesthetical to the space, emits positive energy, and creates balance in the interior environment. It generates sense of wellbeing and comfort as it damps automatically the human body response to stress. Therefore, we have to embed and manipulate optimal golden fractal in interior design and furniture compositions or at least mimic the mechanism of optimal golden fractal to convey emotion and sensation to occupants.

Keywords:

Fractal geometric shape, Iterated function system IFS, Sustainability, Fractal dimension, Hierarchical Self-similarity, Contract transformation, Computational design, Optimal golden fractal structure design.

Paper received 25th August 2018, Accepted 13th September 2018, Published 1st of October 2018