

## The role of Laser Cutting Technology in Enriching Aesthetic Values and Highlighting Artistic Formulas on Leather Fabrics

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### Abstract:

Laser cutting technology has been increasingly popular in recent years. Many well-known fashion designers, particularly in the fashion business, include laser cutting technology into their costume creation. They use laser technology for hollowing, laser cutting, engraving, and other processes, resulting in fashionable garments.

Over the past decade, laser cutting has developed into state-of-the-art Technology Especially in the field of clothing and interior design, especially cutting on MDF wood, which enriched many modern wooden decorations. The aim of this research was to take advantage of these technical formulations in creating artistic formulations resulting from cutting on artificial leather. This article discusses the aesthetic values which produce the use of laser technology in cutting different materials and creating aesthetics of laser cutting on leather material. Because there are so many different laser techniques, such as laser engraving, drawing, laser marking, and laser cutting, but the laser cutting technology was chosen for this study. A descriptive experiment was conducted. An investigation of (15) leather jacket and coat designs that benefit from the aesthetics of laser technology on different materials in unique technological compositions for leather garments. The findings enable the implementation of design concepts on leather, resulting in a variety of trendy effects.

### Keywords:

Aesthetic values  
laser cutting  
leather  
innovative designs

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### Introduction:

A laser is electromagnetic radiation generated by atoms as a result of an oscillation shift. The energy state in which atoms that are promoted to higher energy states release light that is magnified with the use of a number of mirrors is known as 'excited emission'. Many fabrics, such as leather, fur, denim, linen, wool, velour, and EVA foam materials, can be treated dry using laser technology without the addition of any extra materials or colors. The carbon dioxide laser's thermal optical capabilities are also utilized to erode the surface of synthetic fiber and terry fabrics in a three-dimensional manner (P yordanka:2020).

Nowadays, there is a clear difference in cutting technologies applied to leather. Industrial leather processing serves the purpose of mass production of leather items in order to satisfy the demand of essential products like clothes, shoes, bags, etc. This demands from technology to be economically efficient, fast, adaptive and to provide maximum possible results with minimum possible cost. Manual cutting with use of scissors and special knives is used in leather crafting. This allows to produce individual unique items whose value is not determined by functionality but based more on visual effects and design features (Alexander Stepanov and others:2015).

Hence, the application of laser cutting technology has a great potential because of its wearless and forceless processing performance (A.Goeke, C. Emmelmann:2010). This technology could be used to create distinctive visual effects on textiles

without the use of chemicals or contamination. (Spalding, I. J. :1987).

Laser cutting has the ability to produce high-quality, industrial-grade pattern cut-outs, and its output rate is comparable to that of traditional fabric cutting equipment (Nidia K. Trejo and others:2016).

The properties of any material vary slightly when it is treated with a laser, which results in a change in the look of the surface and color changes due to the removal of a layer from the surface or the carbonation that happens on the surface (P yordanka:2020).

### Problem:

The research problem lies in trying to answer the following question:

- 1- How important is the techniques of laser cutting on different materials effect laser cutting on fashion of leather material?
- 2- How effective is laser technology in creating innovative clothing aesthetics?
- 3- How important is the use of different technologies in the field of clothing to enrich the design and production?

### Objectives:

- 1- Creating an innovative design collection of leather jackets and coats resulting from application of laser cutting technology.
- 2- Benefiting from the aesthetics of the motifs used in different materials of laser cutting techniques in highlighting the aesthetics of leather clothing design.

### Importance:



- 1- Interesting in the development of designs made of leather, as leather material is widely used in the field of clothing.
- 2- The increased use of laser technology on different materials has resulted in a plethora of design ideas that could be a source of innovation in a variety of industries, particularly clothing
- 3- Combining laser technology with its application on wood and laser technology with its use on leather materials helps to improve designs.

**Methodology:**

- Descriptive analysis methodology
- Applied methodology

**Review of literatures**

**1- Laser technology**

Laser technology is well renowned for its ability to cut a wide range of materials fig (1), from metals to non-metallic materials. The power and intensity of laser radiation can be easily controlled and applied directly to chosen items (Alexander Stepanov and others: 2015).



FIG(1)applying laser cutting in interiordesign (<https://united-cncuae.com>), (<https://koloapp.in>)

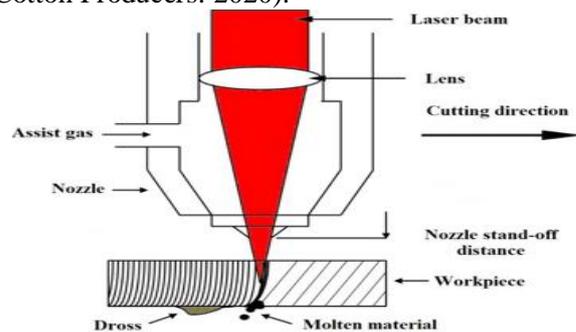
With the advancement of technology in the current world, it is now possible to make design art items from the developed sketch to the material realization of the project utilizing computer graphics. Designers were able to convert the drawing to the material utilizing material cutting technology thanks to vector graphics applications and the introduction of laser and milling equipment with numerical software (CNC). Laser and milling cutting techniques, vector graphics applications Designers were able to ease the process of creating ornamental products thanks to software products and the advancement of technologies and equipment(Priscila Roel De Deus and others:2015).

**2- The use of lasers on textiles:**

Laser cutting technology is a non-traditional method that is currently widely employed in a variety of industries. Despite the fact that numerous materials have been successfully cut by laser and the process has been commercially commercialized, there have been relatively few research on the laser's ability to cut various types of textiles(Nukman Yusoff and others: 2010).

The use of laser as a cutting agent in the textile cutting process is still relatively new. Traditionally, mechanical cutting agents such as discs, band blades, and reciprocating knives are used in this operation. The laser beam is a zero force cutting technology that has the ability to cut at faster speeds because the lack of cutting forces eliminates the bunching up problem that is common in traditional cutting procedures (Mike Jackson and others: 1995).

Class 4 carbon dioxide lasers are the most popular lasers used in textile manufacturing. When compared to other lasing medium, carbon dioxide lasers are high powered and comparatively efficient. They have the ability to operate in a continuous wave mode. Carbon dioxide lasers have a wavelength of 10.6 m, which is in the infrared portion of the electromagnetic spectrum. The energy beam is in the form of heat, which is utilized to burn away the surface of whatever it hits. Carbon dioxide also has the benefit of being a commonly available and reasonably safe substance (America's Cotton Producers: 2020).



Fig(2)A good explanation of the cutting process (<https://all3dp.com>)

Gas lasers, often known as CO2 lasers, are the last and most popular type of laser.

These lasers are available in a variety of powers and are generally used to cut non-metallic materials. Metal can also be sliced with stronger lasers or the use of nitrogen gas instead of CO2

CO2 lasers are the most cost-effective and simple to use, but they require regular maintenance and replacement parts. This makes it ideal for laser cutters who want to get serious about their work (<https://all3dp.com>).

Textile fabrics, composites, and other materials can all be cut with laser cutting machines (Cenna and Mathew 2002).

They can work with a variety of fabrics, which die cutters cannot. As a result, laser cutting equipment are becoming more widely used in the apparel industry (Rajkishore Nayak\* and Rajiv Padhye: 2016).

- No mechanical wear, thus good quality
- No material fixation is required due to force-free processing

- No fabric fraying in synthetic fibers due to formation of fused edges
- It is clean and lint-free
- Simple process due to integrated computer design
- High quality raw materials and significant cost savings.

### 3-Leather material

After employing plant fibers, the first man interacted with leather, which is one of the oldest materials known to man. Man utilized it in the early

periods to protect his body from changes in the atmosphere in general and to protect his feet from wounds in particular, as well as to decorate and put up tents and other structures.

Natural leather and artificial leather are two types of leather. Artificial leather has emerged as a cheaper alternative to natural leather due to its high price and scarcity, and artificial leather may be given the same plastic capabilities as natural leather due to its various colors, thickness, and attractive features (Eman El-Desouky:2011).



Fig (3) leather on the street at Milan Fashion Week Spring 2020  
(<https://fashionista.com>)

Leather is a material that has been around for a long time. It might be claimed that throughout this time, leather treatment techniques, tools, and methods have been constantly evolving. Thus, technology progressed from stone knives and bone needles to industrial cutting, dyeing, pressing, and slitting equipment, all with the same basic goal: to convert leather surface and shape into the desired output. In order to change the shape of the leather, it is necessary to cut it (Alexander Stepanov and others:2015).

### 4- Leather cutting in artworks and fashion

Leather crafting, often known as leather craft, is the process of transforming leather into craft products or works of art through the use of shaping, dyeing, or both processes. Scissors, knives, and draw-gauge knives are among the tools used to cut leather. These instruments are used based on the shape of the cut object and the raw leather substance. Scissors can be used to cut relatively thin leathers, whilst knives are used to cut heavier leathers. For straight lines, draw-gauge knives are the most effective. Straight knives are great for curved lines and sharp edges (Groneman, 1974).



Figure(4) Laser cutting techniques used by artists: cutting with scissors, draw-gauge knife and straight knife (Groneman, 1974).

Laser cutting is widely employed in the leather, textile, and garment industries as a novel processing technology due to its processing precision, speed, ease of operation, and high automation. Laser cutting using positioning cameras can also be used to precisely cut a variety of digitally produced patterns.

Grinding, pyrographing, embossing, and other processing are required in the traditional textile

fabric production process, whereas laser engraving is convenient, fast, flexible pattern change, clear, three-dimensional sense of strong, and able to fully express the true texture of a variety of fabrics (<https://www.goldenlaser.cc>).

Due to the thermal influence of laser cutting, the cut edge becomes slightly carbonized. This effect is more noticeable when the leather is light in color,

such as white or yellow. When it comes to laser cutting, this effect must be considered. The laser cut edge of dark and especially brown leather is the most ideal for laser cutting, however the laser cut edge of light colored leathers can be

plainly visible. Because the thickness of the materials varied, it was necessary to make minor adjustments to the laser cutting parameters in order to achieve complete cutting (Alexander Stepanov and others:2015).



Fig (5) clothing, bags and shoes (www.amorlaser.com)

**5- Experimental work.**

Laser cutting on different materials and the aesthetics of the motifs used in it made it possible to innovate and enrich artistic formulations on leather material to obtain clothing products of a special and innovative character. As a result, the idea of implementing work through the use of different motifs and the possibility of applying them to different designs of jackets and leather

coats, taking into account the distribution of units in an innovative and appropriate manner, and the following is a presentation of (15) designs of jackets and leather coats, where the units were placed using the laser cutting feature on raw materials

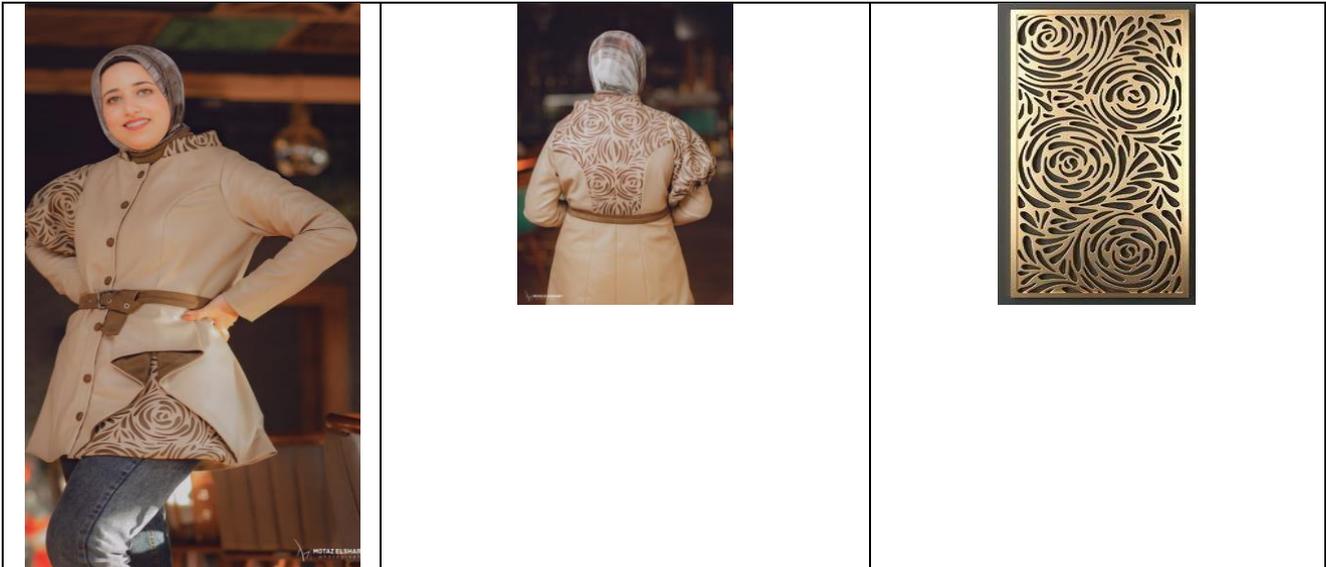
As well as various colors of synthetic leather, which assisted in the creation of good and unique design components.

**Design (1):**



**Design (2):**

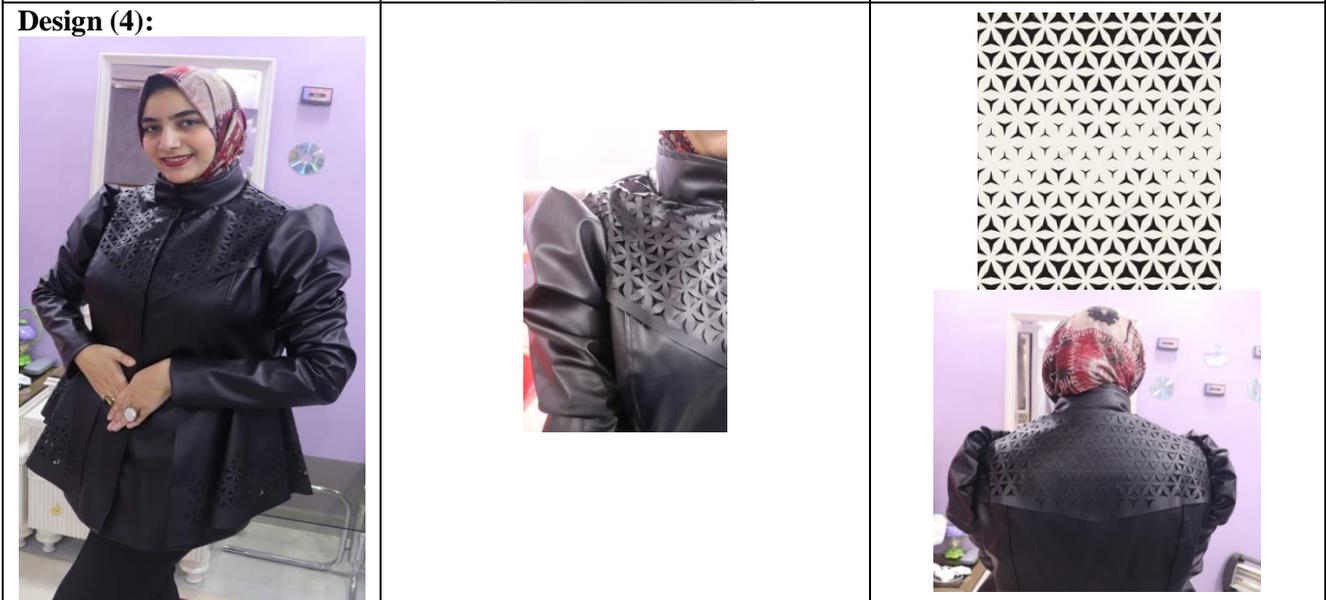




Design (3):



Design (4):



**Design (5):**



**Design (6):**



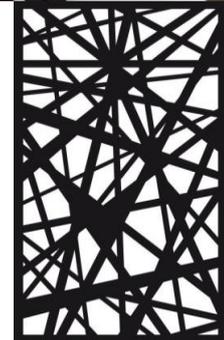
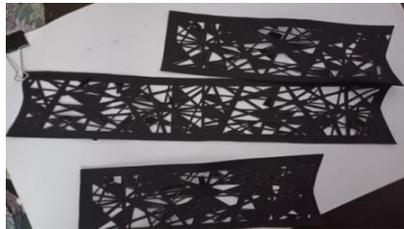
**Design (7):**



Design (8):



Design (9):



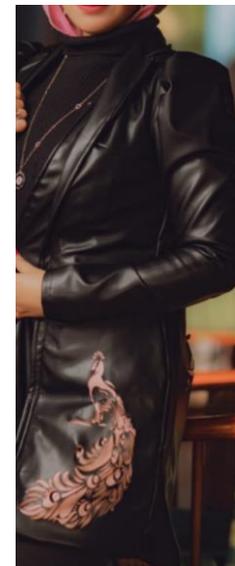
Design (10):



**Design (11):**



**Design (12):**



**Design (13):**



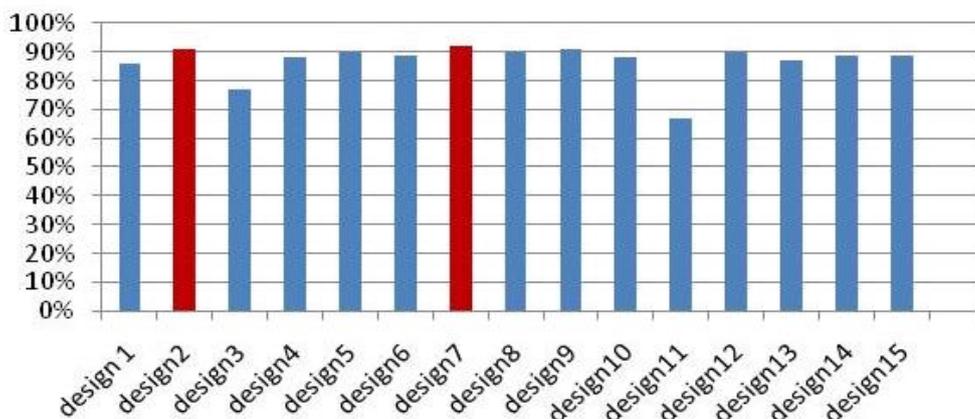


**Statistics and Analysis:**

The questionnaire was authorized from the start to ensure that the study instrument was valid and reliable. There are eight factors which influenced

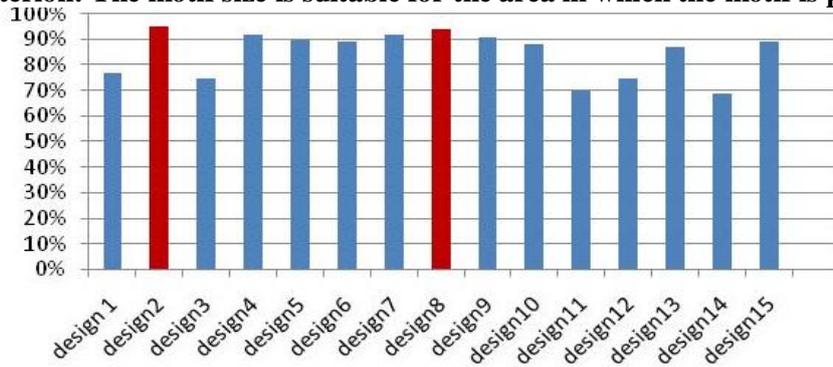
the experimental study to analysis gives results about the quality parameters for designs .

**1- The first criterion: The motif used in laser cutting is unique and innovated**



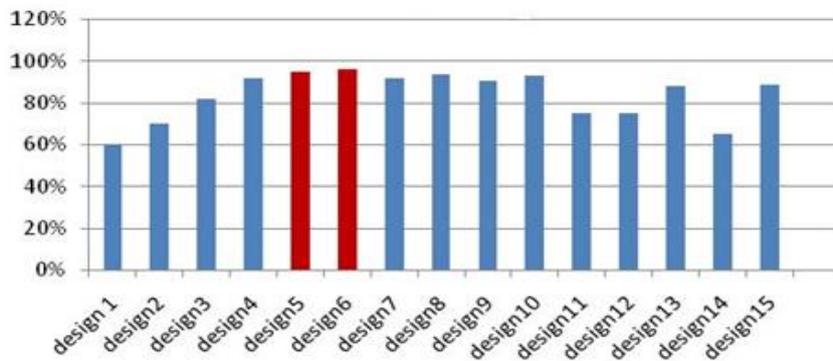
Fig(6) : design (2,7) got the highest quality parameter (92.2%),(91%).

**2- The second criterion: The motif size is suitable for the area in which the motif is placed**



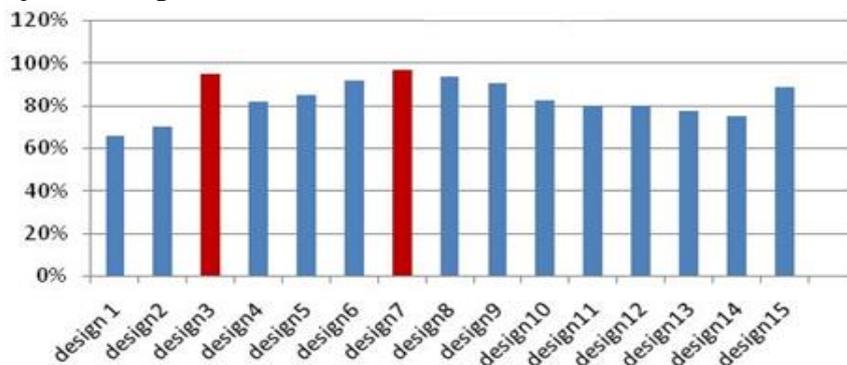
Fig(7) : design (2,8) got the highest quality parameter (94.3%),(93%).

**3- The third criterion: The color used in the blank resulting from laser cutting is proportional to the overall color of the design**



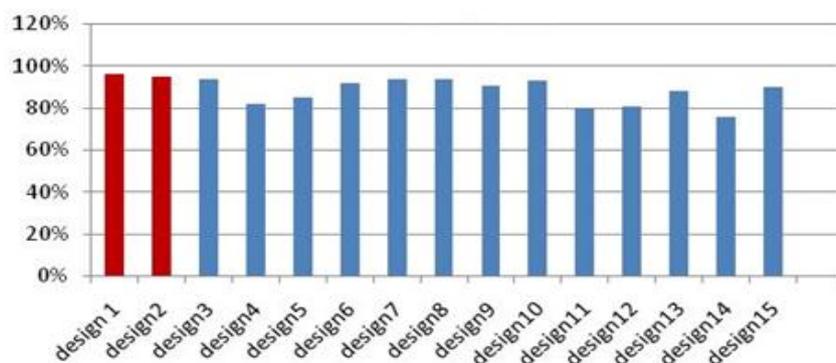
Fig(8) : design (5,6) got the highest quality parameter (95.8%),(96%)

**4- The fourth criterion: The extent to which the color and shape of the motif is achieved to enrich the aesthetic values of jacket design.**



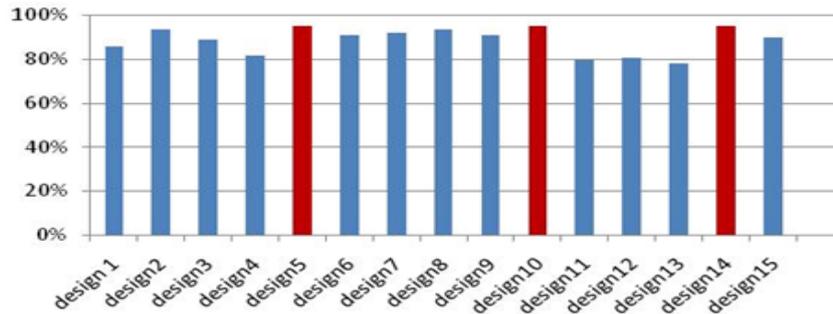
Fig(9): design (3,7) got the highest quality parameter (96.9%),(97.2%).

**5- Fifth criterion: Using laser cutting technology helped create innovative technical formulations for leather jackets.**



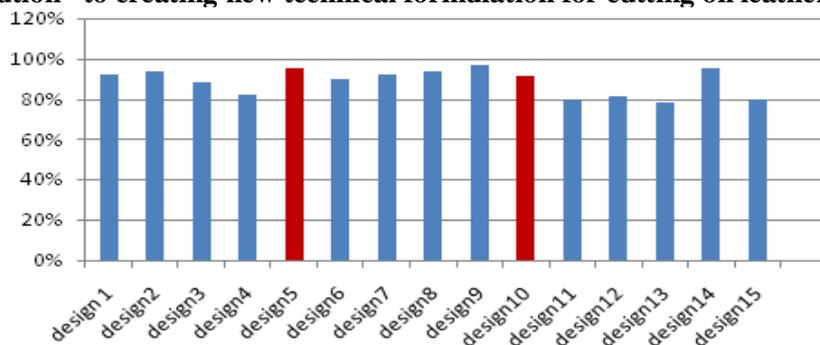
Fig(10): design (1,2) got the highest quality parameter (95.9%),(96.1%).

**6- The sixth criterion: How the design, color, and laser cutting style integrate with the fashion trends of 2021-2022.**



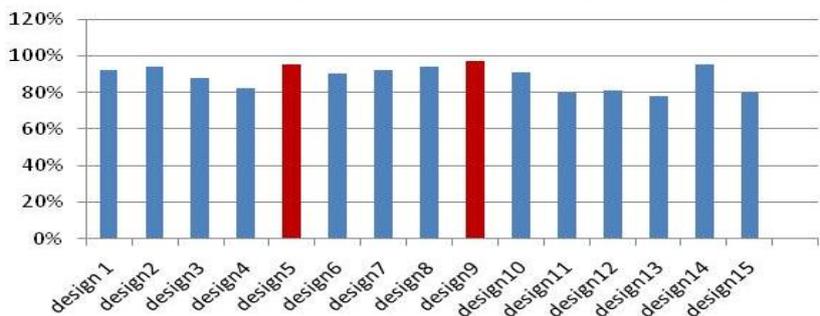
FIG(11): design (5,10,14) got the highest quality parameter (94.7%),(95%),(95.2%)

**7- The seventh criterion: The extent to which the aesthetics of laser cutting technology on different materials Contribution to creating new technical formulation for cutting on leather fabrics.**



Fig(12): design (5,10) got the highest quality parameter (96.7%), (95.3%).

**8- The eightieth criterion: The laser cutting technology didn't negatively impact the function of the jacket design**



Fig(13): design (5,9) got the highest quality parameter (96.7%),(97%).

**Description of the designs evaluation got the highest quality parameters:**



Fig(14) Design no (2)

**Description of Design no(2):**

Coat is Beige synthetic leather and brown chamois (matching fabric), the front of coat with princess cut and bottoms lengthwise. There is cutting in The right of front laser cutting motif was applied, the back of coat with princess cut and laser cutting motif was applied in back yoke, thin belt from brown chamois, same laser cutting motif was applied in Chinese collar to achieve good balance of design, sleeves are not the same the left sleeve was separated balloon.



Fig (15) Design no (5)

**Description of Design no(5):**

simple coat made from pink synthetic leather and purple synthetic leather(matching fabric),in the waist of coat there is a circle cut skirt, owl laser cutting motif was applied in the opened sleeves of coat, the back of coat the same laser cutting motif was applied in back yoke in suitable size, there is good distribution of owl motif and good harmony with colors.



Fig(16) Design no (7)

**Description of Design no(7):**

Open jacket is black synthetic leather and pink synthetic leather(matching fabric), the front of jacket has in the right and in the left tiger pattern laser cutting in large size suitable for jacket design , with tailored collar, the sleeves is the same with laser cutting stripes in sleeves seams, tiger pattern laser cutting also applied in the back of jacket.

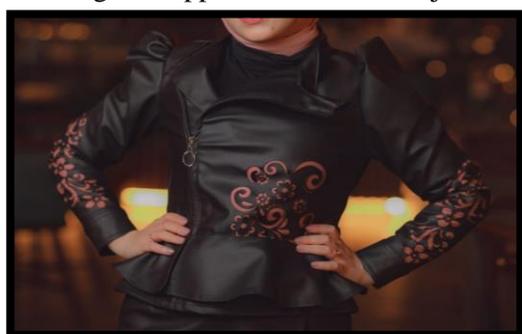


Fig (17) Design no (10)

**Description of Design no(10):**

jacket is black synthetic leather and watermelon synthetic Stan (matching fabric), in the waist of coat there is a small circle cut skirt, zipper closed the last third of jacket, the jacket cutting design is not symmetric, decorative flower pattern laser cutting applied in right back of jacket in suitable size with creative harmony with matching fabric, jacket with shawl collar, ruffle sleeves are the same in the middle decorative flower pattern laser cutting applied in suitable size

**Results:**

- The use of laser cutting technology on different materials and the aesthetic units that arise can have a big impact on how laser cutting technology is used on clothing fabrics.
- Laser cutting technology may be utilized on leather, and it takes up a huge portion of the design rather than a small portion, giving it a different aesthetic shape than traditional designs.
- When using different materials with distinct hues under the hollow parts arising from the components, laser cutting technology provides for aesthetic qualities and improves the artistic formulations of the design.

**Recommendation:**

- Attention to developing the use of laser technology on the skin in all products, especially in the field of clothing and its accessories.
- Interest in combining many technologies with laser technology, such as embroidery or drawing, to enhance designs.
- Take advantage of all the different technologies that help highlight the aesthetic values and adapt them in the field of clothing and use them as new sources of innovation, development and modernity.
- Utilize all of the various technologies that assist in highlighting aesthetic values and adapting them to the field of clothes as new sources of innovation, development, and modernism.

**Conclusion:**

Laser technology can be utilized on a variety of materials, including metals and textiles, to create noncontact patterns. It can be used on a variety of products in the garment industry, from household textiles to fashion accessories. CO2 gas lasers are widely used and successful in the garment production industry.

The laser approach differs from traditional textile techniques in that it allows for greater design and operating flexibility while generating no pollution or waste.

Other advantages of laser over traditional methods include cutting, engraving, embossing, denim fading, and so on. Furthermore, lasers have a

decreased chance of product degradation, need fewer consumables, and do not produce harmful by-products, as some technologies do.

In general, laser cutting is best for cutting complicated geometries and motifs because it offers high flexibility, ease of setup and nesting, quick changing of geometries, and excellent adaptability to various material properties (such as thickness).

For designers, these characteristics make laser an appealing tool for engraving, embossing, and denim fading, among other things.

Thanks and appreciation:

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