

% !TEX encoding = UTF-8 Unicode

%%%

%%

%% This file is asmejour-template.tex, a template to format papers in the style of ASME journal papers.

%%

%% This file is version 1.18 dated 2022/01/10

%%

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%%

%% Class options include:

%%

%% * Option to color the vertical bar in the title block [barcolor = colormame]

%% * where colormame is any name def'd by xcolor package; omit barcolor option to get black

%%

%% * Option to omit the list of figures and list of tables at the end [nolists]

%%

%% * Math options from M. Sharpe's newtxmath package: upright integrals [upint];

%% * [varvw] for a v and w that are better distinguished from Greek nu; [subscriptcorrection]

%% * to fine-tune the placement of math subscripts; and also additional options such as

%% * [smallerops, varg, slantedGreek, frenchmath, varbb, cmbraces]. Version 1.6 or higher

%% * is recommended.

%%

%% * Option to include line numbers [lineno]. The lineno package does not number tables,

%% * footnotes, captions, etc. You must run *twice* for proper placement of the numbers.

%% * This option will disable balancing of the column heights on final page.

%%

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%% * misbehaves, so use it with an awareness that it can create unexpected problems.

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%%

%% * Options for copyright notices:

%% * Omit the ASME copyright from the footer [nocopyright]

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%%

%% * Options for PDF/A compliance. [pdf-a] will produce PDF/A-3u compliance with sRGB OutputIntent.

%% * [pdfapart= 1 or 2 or 3] and [pdfaconformance= b or u] can enable levels 1b, 2b, 2u, and 3b.

%% *

%% * The most recent versions of LaTeX (2021 and later) are moving toward integrated support for pdf-a,

%% * through \DeclareDocumentMetadata{..}. The asmeconf class supports these new features, which can

%% * replace the aforementioned class options. (An up-to-date LaTeX installation is required.)

%%

%% * Many options for calligraphic, script, and fraktur fonts from the mathalfa package; the

%% * example value used is: mathalfa=cal=euler (use Euler font for \mathcal)

%% * some other options for cal are: dutchcal, zapfc, cm (default), boondox,...

%% * frak (fraktur), bb (blackboard bold), scr (script) may also be controlled.

%%

%% * An option to use newtxtext's superiors font for footnotes [nodefaultsup] and an option

%% * for slightly larger small capitals [largesc]

%%

%% * Options for typewriter font

%% * [hyphenate] allow hyphenation (normally suppressed because for typewriter font is often used for code)

%% * [var0] replace default slashed zero by unslashed zero

%% * [mono] force interword separation to monospacing

%%

%% * Options for the babel package to support passages in other languages (such as a translated

%% * abstract in an appendix), e.g. [french]. The main language will default to English

%% * unless a different main language is selected, e.g. [main=spanish]. See Appendix C for details.

%%

%% For details of the newtx and mathalfa packages, refer to their documentation (available at CTAN: <http://ctan.org>).

%%

%% The use of commands defined or modified by the asmejour class is illustrated below. In particular, some care

%% is needed when using complicated math and macros in section headings, to avoid problems with pdf bookmarks,

%% as facilitated by the optional argument of \section (also illustrated below).

%%

%=====

%%

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%%

%%
%%

%% Class options are described above.

\documentclass[subscriptcorrection,upint,varvw,barcolor=Goldenrod3,mathalfa=cal=euler,balance,hyph
enate,french,pdf-a]{asmejour} %

%%%% pdf metadata

%%
%%

\hypersetup{%

pdfauthor={John H. Lienhard}, % <=== change to YOUR
name[s]!

pdftitle={ASME Journal Paper LaTeX Template}, % <=== change to YOUR pdf
file title

pdfkeywords={ASME journal paper, LaTeX template, BibTeX style, asmejour class},% <===
change to YOUR pdf keywords

pdfsubject = {Describes the asmejour LaTeX template}, % <=== change to
YOUR subject

% pdfurl={https://ctan.org/pkg/asmejour},% may delete

pdflicenseurl={https://ctan.org/pkg/asmejour},% may delete

}

%%%% Journal name and optional copyright year %%%%

%% Omit "Journal of". If Journal Name is quite long, use \\ to insert a line break

\JourName{Heat Transfer}%<=== change to the name of your journal

%% The default copyright year is the current year

%% \PaperYear{2022} sets 2022; and \PaperYear{} omits the year entirely.

%% end of preamble

%%
%%
%%

\begin{document}

% Change to your author name[s] and addresses, in the desired order of authors.

% First name, middle initial, last name

% Use title case (upper and lower case letters)

% Note usage below for corresponding author.

\SetAuthorBlock{K M Ahsan Zaman Anik }(Department of Textile Engineering, Wet Processing Engineering\\

National Institute of Textile Engineering \& Research,\\

University of Dhaka,\\

Dhaka, Bangladesh \\

email: ahsanzamanaanik@gmail.com}

% To label one or more corresponding authors put "Name\CorrespondingAuthor". No space after "Name".

% An optional argument can be added if email is not in address block as

% "Name\CorrespondingAuthor{write@to.me}"

% Can also include multiple emails and use the command more than once for multiple corresponding authors,

% "Name\CorrespondingAuthor{write@to.him, write@to.her}"

\SetAuthorBlock{Humayara Tabassum Rodela }(Department of Textile Engineering, Wet Processing Engineering\\

National Institute of Textile Engineering \& Research,\\

University of Dhaka,\\
Dhaka, Bangladesh \\
email: rodelatabassum05@gmail.com}

%%% Change to your paper title. Can insert line breaks if you wish (otherwise breaks are selected automatically).

\title{Technological Advances in Embroidery: Driving the Textile and RMG Industry's Growth }

%%% Change these to your keywords. Keywords are automatically printed at the end of the abstract.

%%% This command must come BEFORE the end of the abstract.

%%% If you don't want keywords, omit the \keyword{..} command.

\keywords{Embroidery, RMG industry, Textile industry, Technological innovation.}

%% Abstract should be no more than 250 words

\begin{abstract}

Embroidery is an ancient craft that involves using colored threads to create designs on cloth. Embroidery has been transformed by technology, through computerized machines and sophisticated software designs became more accurate and the production was faster. Laser Cutting and Heat Pressing have revolutionized our craft along with the new technologies in machines, which has granted us more freedom to create quality works. These factors were responsible for the major growth seen in this sector, which has given designers new methods and materials with which to create innovative and attractive fabrics, helping marketability as well as consumer demand. It is constantly developing, as new methods and materials for its implementation continue to be introduced for this reason a significant growth of the embroidery sector within the textile industry can be seen. This not only improves the appearance of embroidered textiles but also makes them more attractive and marketable to consumers. By innovating and expanding traditional hand work to modern computerized embroidery, every thread technology provides a higher level of the industry that paves success in conventional sewing capabilities by enabling creativity or efficiency on customization. To summarize, the interaction excellent co-operation of our technology innovations with traditional craftsmanship has revolutionized us into a new era in which embroidery segment is visibly taking places under quest-lines through textile industry.

\textbf{References:} Masco Printing \& Embroidery Ltd, MASCO Group, Bangladesh

\textbf{Location:} 318/A Khapara Road, Shataish, Gazipura, Tongi, Gazipur.

\end{abstract}

\date{Version \versionno, March, 2024}%% You can modify this information as desired.

%% Putting \date{} will suppress any date.

%% If this command is omitted, date defaults to

\today

%% This command must come somewhere

before \maketitle

\maketitle %% This command creates the author/title/abstract block. Essential!

%%
%%

%% End of fields to be completed. Now write!

%%

\section{Introduction}

The global fashion industry is continually evolving, embracing trends that reflect both contemporary aesthetics and cultural heritage [1]. Embroidery, an ancient trade, has evolved into a vibrant business with modern technologies and innovative methods in the textile industry. Embroidery enhances the aesthetic effect of fabrics and serves as a means of expression, narration, and identification with culture. It has contributed to visual diversity in various industries, including fashion, interior design, art, and crafts. As early as 4000 years ago, there was a saying in China about clothing painting and embroidery. China is a country with a long cultural tradition, in which intangible cultural heritage is an important carrier of cultural inheritance and innovation. As an important part of it, traditional embroidery is one of the treasures of Chinese culture [2]. In the process of inheritance and development, traditional embroidery faces many challenges and opportunities [3]. With the rise and development of modern design, the application and innovation of traditional embroidery in modern design have attracted much attention [4].

The embroidery industry has experienced significant growth and change in recent decades due to technological advancements, fluctuating consumer demand, and market changes. Traditional hand embroidery by skilled artisans has evolved into refined digital stitching provided by computerized machines, opening new avenues for creativity, customization, and efficiency. Growing awareness for sustainability and ethically produced textiles has triggered innovation in eco-friendly stitching materials and techniques.

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\begin{figure} [h]
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\centering
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\includegraphics[width=1\linewidth]{image.png}
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\caption{Embroidery process via Tajima, TFGNII 920}
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\label{fig:enter-label}
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\end{figure}
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The growth in the embroidery sector has been accelerated by the increasing demand for personalized and customized products. Embroidery allows customers to bring forth their style and character in ways that mass-produced products cannot. This increased demand for personalization has led to new paths of growth and innovation within the embroidery industry, catering to a more diverse clientele base. The most significant contribution of innovation to expansion within the embroidery sector comes from computerized embroidery machines, which have improved accuracy and speed over conventional hand embroidery. These machines allow for detailed and complicated designs that were previously difficult to replicate with manual efforts. This thesis examines case studies, industry trends, and scholarly research to explore how tradition and modernity, craftsmanship and technology, commerce and culture shape the embroidery industry within the context of the modern textile industry.

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\section{Aim of the Study}
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The paper attempts to explore the embroidery techniques of innovations in the textile industry. Precisely, this study researches to:

1. Identify from the hand embroidery to modern digital and automated techniques in an attempt to understand the motive factors for innovation in the industry.
2. Identify and describe the range of technological innovations that have transformed the practice of embroidery through, for example, computer-controlled machines, digital designs, laser cutting, and three-dimensional embroideries.
3. Analyze how innovation influences efficiency, quality, and creativity in embroidered textiles and also influences competition within the market and consumer tastes.

4. Discuss how innovation enlarged the palette of materials, textures, and trimmings available to designers and contributed to the evolution of new techniques and aesthetics in embroidery.
5. Discuss challenges and opportunities created by the adoption of these innovative embroidery techniques: technological barriers, acquiring the relevant skills, cost implications, and environmental sustainability.
6. Case studies and best practices in the industry involve the identification of successful instances of innovation in the embroidery techniques presented herein, along with the lessons and insights that can be highlighted from these cases for practitioners, researchers, and stakeholders concerned with textiles.

Addressing these objectives, the present research paper will deepen the understanding of innovation dynamics in the embroidery sector and will also provide some useful insights and recommendations that will contribute to the advancement of the field in an evolving global textile industry.

\section{Exploring the Evolution of Embroidery Techniques;}

Some of the very early embroideries or stitches are chain stitch, buttonhole or blanket stitch, Bar tacking, running stitch, satin stitch, and cross stitch. The stitches are the same basic techniques in hand embroidery today. Some of the different accessories used for embroidery are also EVA or Ethylene Vinyl Acetate, Lining materials, Sequins, Tapping, Chain beads, Dotted lining, Draw cords, Water-soluble Felt fabrics, Seed beads, and Satin fabric, among other forms. The machines used for embroidery range from the old single and multi-needle machines to advanced, computerized embroidery machines [7]. The machines increase the productivity and quality of the embroidery work in industries such as fashion, textiles, and crafts by enabling the realization of complex designs with close, accurate stitching. Herein follows some information on the types of machines normally used in embroidery:

1. Single-needle machines are considered to be the older type of embroidery machine. They have one needle that has to complete a design. These are used for smaller projects or when one needs to create minute details.
2. Multi-needle machines differ from single-needle ones by having several needles, mostly between 2 and 15, although some with more are found. With the help of multiple needles, it enables speedier production

and the capability to use various colors all at once. Therefore, multi-needle machines are appropriate for larger and more complicated designs.

3. Computerized embroidery machines: The computer technology is inbuilt into these machines to fully control the embroidery. They can read digital embroidery files and automatically embroider the design with high accuracy and consistency. These computerized machines are in wide application within industries for mass production.

4. Combination Machine: This machine incorporates embroidery into one machine that sews, quilts, and surges. They allow versatility for those customers who need multiple functions in one machine.

5. Embroidery digitizing machines: These machines are special in that they serve to convert digital designs into embroidery files readable through computerized embroidery machines. As such, they are used to translate artwork or images into stitch patterns during the design process.

6. Industrial embroidery machines include increased stitching speeds, larger embroidery areas, and robust construction, making them fit for heavy-duty use in high-volume production of commercial embroidery. They range from large and complex with more capabilities to the simpler models, aimed at different industries and levels of skill.

It is an industry that grows through varied types of embroidery machines, such as Tajima, Maya, Sun Star, Rich-Peace, among a host of others. From the point of view of operation, the traditional hand needle is a single thread embroidery with one side of the needle, and the position and direction of the needle are free. For example, messy needle embroidery is a kind of needlework developed under the high freedom of entering and leaving the needle. Its high degree of freedom, the embroidery thread according to the will of the embroiderer to freely deploy, with the use of needlework, to achieve a delicate soft effect due to the characteristics of its handmade in the production of the duration of the embroidery need to consume a lot of energy and time. Moreover, for a long time, “embroidery” and “painting” were separated; the embroiderer needed to embroider through the tracing of the painter’s work, and most of the embroidery is a flat pattern, and the spatial characteristics of the two-sided shuttle of the hand needle are not maximized[5].

\subsection{Types of Embroidery }

\begin{enumerate}

\item Regular Stitch / Normal Embroidery

\item Sequin Embroidery

\item Beads Embroidery

\item Tufting Embroidery

\item Terry Embroidery

\item Tapping Technique Embroidery

\item Spangle Embroidery

\end{enumerate}

The running stitch, backstitch, split stitch, stem stitch, satin stitch, and French knots are the six fundamental embroidery stitches. Embroidery machines are pushing industries to new heights. The technology saves time while simultaneously providing exact stitches, ensuring that the design is accurate.

\section{Production and Equipment: }

The main equipment for the Embroidery is yarn/thread, Bobbin, Lining, Embroidery machine according to the technique. The kind of embroidery that can be made is huge as embroidery machines can produce several kinds of designs attributed it with the title of ancient art of stitching, because embroidery machines can perform regular or normal stitch types of embroidery methods universally. However, specialized forms like Tufting, Terry, Sequins, Chain Beads, and Draw cord embroidery are specialized techniques and must have specific sorts of embroidery machines essentially built for their designs. Each of them serves the specifics of a particular method with attention to the last detail and quality of the final embroidered products.

\section{Raw Materials used in Embroidery: }

Yarn or thread is the primary raw material used in embroidery. While a variety of sewing threads can be used to create embroidered designs, filament thread is more commonly utilized in bobbin needles. Sewing thread made entirely of spun polyester from ECO threads is beneficial for embroidery because of its strength, dyeing quality, and luster.

\section{Regular Stitch / Normal Embroidery:}

This kind of needlework does not necessarily fit into a category or technique. It is, quite simply, surface embroidery. Its "free" or "free style" embroidery actually refers to the fact that it is done without using a fabric grid.

In short, there are three common meanings associated with the word "surface embroidery":

1. "Free style" or "free" needlework which is not counted
2. ornamental needlework which cannot be classified by method

3. Some use the term generally for all forms of embroidery.

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\begin{figure} [h]
\centering
\includegraphics[width=1\linewidth]{Screenshot 2024-11-03 122430.png}
\caption{Regular stitch / Normal stitch embroidery}
\label{fig:enter-label}
\end{figure}
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\section{\textbf{Sequin Embroidery }}
}
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A sequin is a small glittering disk of plastic or metal sewn onto garments as an ornament. Sequins are used in this decoration method to form dazzling logo designs. The design, after preparation, is digitally transformed into a sequin dot format. Sequins are directly embroidered on the garment to form the design. Although plastic is now used extensively, even though it may be coated in metallic paper or a present, this embroidery was done originally with metallic disc-shaped beads. To give added sparkle and gleam to the cloth, some sequin work uses discs that have more reflective surfaces. Sequins can range between 2 to 22 mm in diameter. You can use anything from the tiniest sequins to the largest, or even shapes like noncircular or eccentric types, which depend on the intended usage for creating your patterns.

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\begin{figure} [h]
\centering
\includegraphics[width=1\linewidth]{Screenshot 2024-10-31 125439.png}
\caption{Sequin Embroidery}
\label{fig:enter-label}
\end{figure}
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The present invention relates to a manufacturing process for double-side embroidered sequin embroidery, more particularly comprising the following processing steps:

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\begin{figure} [h]
\centering
\includegraphics[width=1\linewidth]{Screenshot 2024-10-31 125708.png}
\caption{Manufacturing process of double-side embroidered sequin embroidery}
\label{fig:enter-label}
```

\end{figure}

1) selecting fabrics required for processing; 2) selecting sequins required for processing as needed; 3) designing a sequin pattern; 4) mounting two rows of sequin guiding nozzles in parallel on an embroidery head of a computer embroidery machine, mounting the selected A, B, C, and D types of sequins on different sequins guiding nozzles; 5) putting 4 layers of water soluble membranes below the fabric, fixedly mounting the water soluble membranes and the fabric in an embroidering position of the computerized embroidery machine by using clamps; 6) arranging the sequins on the fabric, fixing one side of each sequin with a single needle so as to fix a single side of each sequin on the fabric and the water soluble membranes row by row, wherein the sequins can turn over forward or backward from right side up to back side up; 7) when embroidering is finished, cleaning the product in cold water till the water soluble membranes are removed completely. Through equipment improvement, with two parallel sequins, two kinds of different colors may be changed without fix lines. [6]

Sequins vary in size, shape and color. They can be glossy or matt, reversible or one-side. The most popular backing fabrics include tulle or chiffon. For some time, THE design outcomes with reversible sequine design. They are sequins that have the hole for sewing displaced from the centre to the side. That makes it possible for them to be turned over freely after being sewn on.

\begin{figure} [h]

\centering

\includegraphics[width=1\linewidth]{Screenshot 2024-11-04 124041.png}

\caption{Double-side embroidered sequin embroidery}

\label{fig:enter-label}

\end{figure}

\section{Beads Embroidery: }

The hallmark of Tambour or Luneville embroidery is that the beads are attached on the reverse side of fabric and chain goes on the right side of fabric, while in the case of Zari and Aari works, the beads are attached to the right side of the fabric on which the chain stitch is formed. Bead embroidery is such a sensitive sewing of beads on the surface of cloth, suede, leather, or any foundation material used for beautification of the surface. Bead embroidery has a very important application in garments, accessories, as well as jewelry.

The most common materials from which beads are made include metal and gemstones. Other types of materials from which beads can be made include glass, ceramic, porcelain, crystal, enamel, and many others.

\begin{figure} [h]

\centering

\includegraphics[width=1\linewidth]{Screenshot 2024-11-03 123851.png}

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\caption{Metal beads and Beads Embroidery}

\label{fig:enter-label}

\end{figure}

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\section{\textbf{Tufting Embroidery }}

}Tufting embroidery or punch needle embroidery or toothbrush embroidery refers to a surface technique of embroidery. It gives texture to fabric by punching loops of yarns or threads through it. The word tufting means "decorated with a tassel". Tufting embroidery, more commonly referred to as tufting or punch needle embroidery, consists of stitching designs on fabric that are raised by means of a special needle or tool. By punching loops of yarn or threads onto the fabric, this type of surface stitching goes on to create tufts or elevated heaps. Tufting stitch embroidery is the technique with which a velvet floss pile-like fabric is made by a combination of machine embroidery and hand-made trimming, and as such, maximizes the fullness and softness.

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\begin{figure} [h]

\centering

\includegraphics[width=1\linewidth]{Screenshot 2024-11-06 121906.png}

\caption{Tufting embroidery}

\label{fig:enter-label}

\end{figure}

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\section{Terry Embroidery}

Terry embroidery is the process through which the embroidered design is added onto terry cloth, a soft, absorbent fabric with loops on one side. The terry cloth can be used for towels and bathrobes or can be used in some other manner, depending upon one's preference. It may comprise quite a number of designs from monograms to varied initials. Loops of Terry are long on either side. It may have the same loop length in both sides or it can have longer looped in only one side. The longer side will be softer and will serve as an absorbent to help you take away the moisture quickly from your skin. This fabric is ideal to make bath mats, towels, and robes. Acrylic yarns or thread is very commonly used in Terry embroidery techniques. Fancy and aesthetic designs are the only ones that suit terry embroidery. Terry embroidery is a kind of specialized technique done on a particular fabric called terry cloth, which is characterized by pile on one or both sides. This particular texture, comprising loops that allow for great absorbency, makes terry cloth apt for items to be used as towels, bathrobes, and bath mats. On the other hand, this texture also presents some challenges and opportunities concerning embroidery, which have to be duly considered in terms of the materials and techniques applied to them. Some of the characteristics of terry embroidery are listed below.

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\begin{figure} [h]
  \centering
  \includegraphics[width=1\linewidth]{Screenshot 2024-11-06 120638.png}
  \caption{Terry embroidery}
  \label{fig:enter-label}
\end{figure}

```

1. Selection of Thread: Terry embroidery generally uses acrylic yarns or threads that are very durable, colorfast, and can be used to create bright vibrant designs. Acrylic threads possess the added advantage of being resistant to shrinkage and mildew; therefore, they are good to go in items that will be washed time and again and thus exposed to moist conditions.

Polyester threads remain the favorite in terry embroidery for having strength and resistance to fading. Cotton threads can be used for a soft, natural look that is not as durable as their synthetic alternatives.

2. Design Considerations:

Fancy and Aesthetic Designs: Since terry cloth is a fabric with texture, simplicity and boldness generally tend to work best in the design. Large areas filled in or thicker lines have more of a tendency to stand out against the grain of the textured background, while detailed or fine patterns might disappear into the loops of the fabric.

3-D Effects: Loops in terry cloth may give an embroidered design a three-dimensional trait that is striking. On the other hand, techniques like satin stitch or using heavier threads bring about designs raised and popping from the surface.

3. Stabilization Techniques: Stabilizers play an important role in terry embroidery that keeps the fabric still, the design sharp, and well-oriented. Often, a water-soluble topper is placed on top of the terry cloth to hold down the loops and keep them out of the way of the embroidery stitches. Normally, a tear-away or cut-away stabilizer is usually placed on the back of the fabric to add extra support in the course of embroidery.

4. Loop Management: Terry fabrics may have uneven or variable lengths; some fabrics have equal loop length on both sides, but more often, one side of terry may have longer loops in order to enhance the softness and absorbency of the fabric. The existence of such loops in terry embroidery is very critical as these loops may cover the fine details of a design. Temporary flattening of the loops is usually done with

a topping material to make the embroidery sit neatly on the surface of the fabric; this topping material may be a water-soluble film.

5. Applications: Terry embroidery has its broad use in producing items like towels, bathrobes, and washcloths for bathrooms. Indeed, stitched designs create the impression of their luxurious look and being personalized. One more component of embroidered things is the bath mats, which are very functional and decorative. Moreover, terry embroidery is used in the creation of the baby world, such as in hooded towels and bibs, where the softness and absorbency of the fabric are quite necessary.

6. Durability and Care: Terry embroidered products are made to withstand numerous washes and heavy use. The proper thread selection in high quality and proper stabilization will ensure that the embroidery remains intact after repeated washes with vibrant colors. Following the care instructions, such as using only mild detergents and not strong bleaching agents, will help to extend the lifetime of both fabric and embroidery.

\textit{Challenges and Techniques in Terry Embroidery}:

Terry embroidery is a little tricky, as its fabric is dense and has a looped surface. The main thing that can help in terry embroidery is the management of loops so that the design may stand out and be sharp. For that, some techniques become necessary, such as using a topping stabilizer, picking appropriate designs, and using threads appropriately. Moreover, machines can also be regulated for improved stitch density and longer length for better results.

In other words, terry embroidery is a specialized technique of adding an extra aesthetic and functional value to terry cloth products. Thread selection, management of loops, and proper use of stabilizers will allow the embroiderer to get great-looking and durable designs that will enhance the appeal of items such as towels, robes, and bath mats. The blend of functionality and visual appeal greatly makes terry embroidery very popular both in personal and commercial textile products.

\section{Tapping and Cording Embroidery:}

Tapping is perhaps one of the most attractive techniques in embroidery. Generally, cording and fabric by laser cutting is used for tapping. In general, cording embroidery is a specialized mode of embroidery, enabling us to sew on materials such as ribbons, pearls, cords, and ornate chains. This kind of embroidery is commonly called "bead embroidery," because it allows us to sew on beads in a fast way-the embroidery machine does everything for us, and we don't have to do this by hand. Cording embroidery is a specialist embroidery technique that lets us sew on materials or patterns made from ribbons, beads, cords, or decorative chains, like metal or plastic chains. Very often, this type of embroidery is also called

"bead embroidery", because it allows us to sew on beads really fast-the embroidery machine is doing everything for us, not our hands.

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\begin{figure} [h]
\centering
\includegraphics[width=1\linewidth]{Screenshot 2024-11-06 121106.png}
\caption{Tapping and Cording Embroidery}
\label{fig:enter-label}
\end{figure}
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Types of Tapping \& Cording:

Current embroidery machines have made decorating materials easier and quicker. We can offer our clients cording embroidery which enables us to sew beautiful features such as: Cassettes, beads, decorative chains, and cables. Moreover, we can offer you two other sewing methodologies for patterns designed using cording embroidery. These are: Tape or zigzag.

Both of the methods above enable us to make two quite different variants of the very same pattern/design. In the tape variant, one sews the cord along its middle. This causes the cord to become flatter and wider. In the variant of zigzag stitching-as the name says-the string is sewn once from the left side and once from the right.

\section{\textbf{Laser techniques in Embroidery} }

The embroidery cutting laser machine, otherwise known as a patch-cutting or applique-cutting laser, was specially developed for textile; it cuts complicated designs or patterns from fabric or any other material with great accuracy. These machines make clean and accurate cuts using a focused beam of the laser, which is normally used in creating patches, appliques, and detailed embroidery elements. The laser cutting technology in embroidery machines brings forth detail and efficiency somewhat hard to achieve with traditional methods of cutting. These laser embroidery machines work their magic by directing a laser beam onto the fabric or other material, which in turn melts, burns, or vaporizes the material at points that are specified with the design. This is the computer software-controlled cutting that allows operators to pre-program patterns in accurate dimension and shape. The laser beam, without touching or coming into contact with the fabric, cuts out the pre-programmed designs in desired shapes in the fabric, further minimizing distortion or damage to the fabric. This results in highly accurate cuts that enhance the quality and consistency of each piece.

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\begin{figure} [h]
\centering
\includegraphics[width=1\linewidth]{Screenshot 2024-11-06 123554.png}
\caption{Computerized embroidery cutting laser machine}
\label{fig:enter-label}
```

\end{figure}

The common applications of embroidery laser machines also include patch cutting and applique cutting. In patch cutting, machines cut patches on which, afterwards, embroideries may be made in various designs. These are usually used in uniforms, branding, or fashion, and need precision to look professional. In appliqué cutting, it cuts pieces of fabrics, which are then applied onto another in a layered design. It is very common in decoration apparel and accessories where detailed designs are layered onto a base fabric, thus bringing forth a textured visual pattern. The precision of laser cutting enables one to cut out complex shapes and do detailed work; this makes the appliques look seamless and really emphasizes the aesthetic aspect.

With the design for speed and efficiency, their perfect application is in high-volume production environments where precision and consistency are key. They can cut into a range of fabrics, from cotton and polyester to leather and synthetic blends. Advanced models have been made to cut through many layers of fabric at one go, which can really speed up production times when bulk orders need processing. The accuracy of the laser comes in handily where the designs involved are complex or the required tolerance is minimal, in that it treats all parts uniformly regardless of how complex a certain design may be. Embroidery cutting laser machines also bring advantages in terms of waste reduction. Since the cutting process is so accurate, it reduces excess fabric waste significantly, which is a huge advantage in industries with the focus on cost-efficiency and sustainability. This saves on material waste, especially when using costly fabrics. Besides that, since laser cutting is a non-contact method, the edges of the fabric are often sealed by heat at the point of cutting, hence preventing fraying, and adding strength to the final product.

\begin{figure} [h]

\centering

\includegraphics[width=1\linewidth]{Screenshot 2024-11-06 123903.png}

\caption{Chiffon Cutting Machine}

\label{fig:enter-label}

\end{figure}

The figure shows the CO2 laser cutting machine for precision cutting in textile applications. Most probably, such a machine would be used for making patches, appliques, and other intricate patterns on fabrics. CO2 lasers find wide applications in the textile industry due to their manifold capability in cutting a wide range of materials like fabric, leather, synthetic textiles, and many others, with precision and speed. This enclosed design means it's safe-the laser beam is encapsulated inside the machine. Dual laser heads, as can be seen here in red, mean high capacity: cut multiple parts or patterns at once to increase productivity.

It appears that the fabric is placed on a flatbed on which the laser heads, controlled by the computer system of the machine, trace the pre-programmed designs to make very accurate cuts without touching the fabric. Such a no-contact approach means a minimal rate of fraying and clean edges; it is ideal for fragile materials. The machine also features variable adjustments in the intensity and speed of the laser so it can work on an extremely wide range of different fabric types effectively.

\section{Conclusion}

Technological advancements in embroidery have significantly impacted the textile and ready-made garment industries. Modern techniques, including computer-aided design, automated machines, and digital printing, have increased production rates and accuracy, allowing manufacturers to meet the ever-changing global market demand for quality products at low costs. The adoption of sustainable and eco-friendly technologies has aligned the industry with global sustainability trends, making it resilient and adaptable. The blend of technology and traditional craftsmanship in embroidery has transformed the textile industry into a promising one for economic growth and innovation. Further research and development will lead to even more advanced techniques, ensuring embroidery remains at the heart of the success of the global textile and ready-made garment sectors.

Sustainability has become a prime concern in the evolution of embroidery technology, with eco-friendly practices, materials, and energy-efficient machinery ensuring minimal environmental degradation. The integration of technology with traditional craftsmanship has created a dynamic, innovative embroidery landscape for the textile and ready-made garment sectors.

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