Implementation of CAD/CAM in Weaving System

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Ph.D. Clothing & Textiles
Department of Clothing and Textiles
G.B. Pant Univ. of Ag. & Tech., Pantnagar. (U.K.)

INTRODUCTION

CAD/CAM is virtually a “No Limit” solution for textile designing and manufacturing because it has enormous application area. With the introduction of computer aided designing and computer aided manufacturing technology it is possible to make modern designs and unique color combinations which can easily satisfy the consumer’s need. Now the fabrics are more attractive and more competitive in today’s rapid changing fashion world. High quality exportable textile products including apparels, furnishing fabrics, upholsteries, blankets, carpets and so on, are made with help of CAD/CAM system, showing higher potentiality of revenue generation from export market.

Computer aided design technology allows the creativity of the textiles designers to run free; hence it is being used more and more in textile industry. CAD/CAM is heavily used in textile industry as a designing medium as well as a tool for production. In power loom sector of our country, almost every composite textile mill has adopted this type of CAD/CAM tools for textile designing and manufacturing in their R&D lab. The software is so efficient that it produces all the required outputs within a few seconds and allow the craftsman show more and more creativity.

WHAT IS CAD/CAM?

CAD/CAM is the contraction which stands for Computer Aided Design / Computer Aided Manufacturing. This term means different things to different people involved in designing, manufacturing and mechanical engineering.
WHY CAD/CAM IS NECESSARY

Today every coming generation is more fashion conscious so there is huge demand for new-fangled weave designs. With these conditions designers have difficulty in keeping pace with the fast changing trends of the market. Some times they find that they are not ready to cater the market needs. It is not easy to them to remain competitive, by merely depending upon the traditional way of designing, because today’s design becomes out of fashion tomorrow. Hence they loose a share of market, so to keeping pace with fast shifting trends of market computer aided designing and manufacturing is very much required.

It is well known phenomenon that human being is always in search of opportunities related to saving money, time and comfort. Any textile industry will think in terms of improving the efficiency, maximum utilization of resources and improvement in services for customer’s satisfaction. Search of these elements leads towards development and use of new technologies. As the proverb says “Creativity is one percent inspiration and ninety-nine per cent perspiration.” but computers have confirm it wrong. They have made textile designing simpler, faster, more precise and enjoyable. The designer can create his motifs with a mouse or pen. Once the design is created, further process of editing the design i.e. clipping of certain parts, adding new shapes, changing the shapes, distortion, resizing, recolouration, color reduction, replicating and combining as per the need can be done at the minimum possible time. Also, one part of design can be altered without affecting the rest.

The other benefit is its wide application in different types of fabric designing. CAD system can be effectively used for designing Suiting/ Shirting, Sarees, Furnishing and Upholstery Fabrics, Blankets, Terry Towel, Carpet, Labels, Knitwear, Bed Covers, Velvet and other. Various complicated weaves can be made easily, one need not to worry about the complicated drafting and peg plans, and the effect of supposed weave can be seen immediately before actual production.
FEATURES OF A GOOD CAD/CAM SYSTEM

A good CAD system should enable us to create design ideas quickly and easily to enhance the way that we already work. The following is a list of **check points** that any good CAD system for woven textiles should be capable:

**Design (CAD)**
- Easy to use and learn
- Good instruction manuals and online help
- Allow us to create libraries of yarns, weaves and designs
- Allow us to create and change designs quickly and easily
- Generate new designs ideas quickly and easily

**Production (CAM)**
- Obtain accurate printouts with a colour printer
- Obtain printed production data (loom card) with weaving instructions
- Create data to interface with electronic textile machinery
- Send design information by e-mail easily to other sites

ADVANTAGE OF USING CAD/CAM OVER MANUAL DESIGNING

1. **Speed & Ease of designing a pattern**

In the traditional way of designing, a squared ruled graph paper is used. This way of designing is very painstaking and requires a great deal of patience and skill. The appearance of pattern can not be known unless it is woven. A small change in a design may require a lot of time and labor, but with the help of CAD we can quickly see the actual fabric display on screen within a few minutes and if you wan to change reed/pick ratio or want to see the design in different color patterns it could be done immediately.

2. **Repeatability**

In the manual designing system one can not get exact replica of the old design (including colors) after some laps of time. To over come this with the help of computers one can get exact replica of design at any time with the exact colour combination.
3. **Flexibility**
Designing with computers is very flexible and time saving. In the traditional way of designing on paper if any modification is required, the pattern has to be erased and redrawn or the whole pattern has to be rejected, and new one has to be redrawn. In a computer once a design is drawn, one can delete a part of the pattern, or modify it, with just putting some commands. Computer can be programmed to generate a variety of different colors and color combination for a particular design, these colors can be selected as per needs.

4. **Lower production Cost**
The cost of design should be according to the market it is suppose to serve. With the help of computer, it is possible to print the design in the catalogue for sales, without actually weaving the fabric. This reduces the inventories at various stages and will reduce the cost production. We can produce more designs in less time, with CAM productivity is very fast.

5. **Less errors in production**
Because of the high degree of precision in computer designing and manufacturing, human errors are almost omitted. Less wastage is there hence maximum utilization of resources is possible.

**APPLICATION AREAS OF SOFTWARE USED IN WEAVING INDUSTRY**

**Components/Modules**
All the CAD/CAM solutions consist of several common modules like:

- **EDIT MODULE**: it is the mother of all modules. Edit is one of the modules, which can cater to the needs of jacquard, furnishing, carpets, dress material, knitwear and many more industries. This module combines an excellent collection of painting tools, and power retouching capabilities—all in one easy to use windows application.
- **DOBBY MODULE**
- **JACQUARD MODULE**
• PRINT MODULE
• WEAVE LIBRARY
• COLOUR LIBRARY
• YARN LIBRARY
• CHECKS AND STRIPS MODULE: extra component to produce virtually unlimited varieties of checks and stripe effect in the fabric.
• CAM module: The CAM module prepares the data to be sent to the machines: Looms, Warping machines, drawing machines, interfacing the software installed by the different machines suppliers. This is how to distribute all the information contained in system also to all the production departments, saving time and decreasing the errors.

User interface of the modules
The unique customization feature facilitates redesigning the Graphic User Interface (GUI) according to our needs:

➢ Keyboard, Toolbar and Desktop customization.
➢ Palette customization.
➢ Different views facility.
➢ Design view.
➢ Graph view.
➢ Repeat view.
➢ Multiple design view.

SYSTEM REQUIREMENTS FOR CAD/CAM
The following are the minimum requirements for the optimum performance of CAD/CAM weaving software:

Hardware
➢ IBM compatible INTEL Pentium III/750 MHz or higher.
➢ 256 MB RAM or higher.
➢ 20 GB HDD or higher
➢ 1.44 MB FDD
CD Drive
LAN Card
17” or 21” Colour Monitor
Keyboard, Mouse

**Operating system**
MS Windows 2000 with service pack 2/XP professionals.

**Peripherals**
- Flatbed Scanner.
- Cordless Digitizer (preferably 12 in x 12 in).
- Inkjet Colour Printer.
- Laser Printer.
- Plotter (24”/36”/42”).
- Zip drive or CD writer (for backup purpose).
- UPS (1 KVA).

The peripherals must be compatible with MS windows platform. The hardware requirement may vary with the particular brand of package to be installed.

**CAD FOR DOBBY DESIGNING**
In the Dobby design system, a software package is developed to represent the warps & wefts in graphical form on the monitors screen. It has collection of useful tools for easy creation of any kind of weave. We can create these weaves and can get peg plan & drafting plan automatically. We can create various kinds of yarns normally used in the industry and use these yarns for developing the fabric simulation.

The Dobby CAD system facilitates the creation of numerous designs quickly and can be varied or changed instantly. The simulated fabric printout reduces the time delay and cost, prior to actual production. The screen image of simulated weave shows a real image of woven fabric. The designer can easily change colour sequences, yarn types or weaves and can check the results on colour screen without wasting valuable time for loom sampling. We can also vary the reed/pick or color of yarns and see simulations with
different parameter and in a faster efficient way. The final design data is then fed to
dobby card punch, or directly to loom fitted with electronic doby.

**CAD/CAM module for doby industry**

Common features of doby module are:

**Weave creation**

- Dobby has a collection of useful tools for easy creation of any kind of weave.
- Automatic generation of Draft and Peg plan from a given weave.
- Automatic generation of weave from any given Peg plan and Draft.
- The interface is such that user can work on all the three views (design view, draft view and peg plan view) simultaneously. The user can either create a weave or generate Peg plan out of that and vice-versa.
- There is no limitation of the size of the Design Repeat or the number of Heald, Shafts to be used to produce the Design.
- Keeping the draft constant and by changing the peg plan only, we can create a wide number of different kinds of designs effortlessly. Thus, we can create designs without changing the Drafting Order repeatedly – one of the unique feature of this module.

**Ordinary and fancy yarn support**

We can create various kinds of yarns including fancy yarns normally used in the textile industry, and then use these yarns for developing the fabric simulation accordingly. The yarn creation facility retains all the technical details of a particular yarn. We can also do the editing of yarns in the doby application. It can edit the appearance and parameters of yarn like count, denier, multiply and slub yarns.

**Yarn layout specification**

We can specify yarn count (in tex/denier/cotton system), yarn twist (S/Z), yarn colour, etc in the yarn information dialog box and store the particular yarn for further use for fabric simulation purpose.
**Fabric simulation**

This feature allows seeing the virtual fabric of the created design even before the production of actual fabric. After seeing the simulation, we can do any kind of changes required. The results of simulation and the actual fabric to be produced are alike- what we see is what we get. We can vary thread density (i.e., end/inch and picks/inch) or colour of yarns or yarn types or warp/weft arrangement, and see the simulation with different parameters easily and in faster efficient way.

**Simulation colour ways**

Using system colour pallet, we can view the simulation of the created design in 16.7 million colour combinations. Colour library allows us to create own pallet of colours. Custom colour pallet can be used to view different simulated colour combinations. Automatic colourways feature unable us to one colour combination of the simulated fabric per second. The simulation will pick colour from our colour pallet automatically and continue with various possible number of colour combinations, depending upon the number of colours in our pallet.

**Other features**

- We can apply warp colour pattern to weft automatically.
- Warp and weft colour patterns can be interchanged instantly.
- We can get the per cent RGB/CMYK composition warp and weft colours in design.
- We can view fabric simulation in different denting pattern.
- Extra warp and extra weft can be added to an existing design automatically.
- We can view reverse, mirror and invert of the weaves.
- Two designs can be merged into one.
- We can get yarn requirement for different materials.
- There is also a facility of on-line weave creation and filling.
Production Report Printouts
Both peg plan report (weaving parameters) and graph printouts can be obtained easily to weave the created designs into actual fabric form.

CAD FOR JACQUARD WEAVE

For doing jacquard, CAD is a production necessity. Complicated patterns and picture effects are made possible by the computer programme instructing the loom to move the threads into new positions. The traditional jacquard designing starts with the conversion of a sketch or design concept into a point paper rendition of the pattern. Grids on point paper represents wrap & weft yarns of a fabric. A designer paints the design concept with complex weave effects. This whole process takes several days before complete design concept painted on square graph paper. After the point paper is completed a card cutter read the point paper line by line and then translates it into a jacquard card, using a card punching machine. Production of a jacquard from the start of the point paper painting process through to the production of the jacquard card set often requires at least 2-3 weeks, even then there is always possibility of manual errors in design, painting & card punching.

Process of jacquard designing by CAD/CAM
In the Jacquard design system, a software package is developed to represent the warps & wefts in graphical form on the monitors screen. The very first step to create the jacquard design is to choose the motif. It can be get by scanning the art work or drawing a outline of a picture. The various tools present in computer software helps to make a beautiful design in just no time. The design is edited now to make it perfect as required and can be set into desired repeat, color & size.

It may be required to fit in a particular number of hooks and picks. Every four sides of motif may be checked for a match etc. After this the process depends on application. A jacquard designer may introduce the weaves (bindings) on each of the colors in the design. The designers just have to specify the weaves. The software of CAD
system will do the actual work in seconds. The resultant graph is printed out on the printed for card cutter, or computerized card cutting m/c can be connected directly with computer and if there is electronic Jacquard on loom it could be directly interfaced with CAD.

**Features of Jacquard Designing CAD**

- Any size of design can be prepared. Design with 1344 hooks and 55,200 picks at the maximum
- Any no. of colors possible
- View of actual cloth mode with thread colors and size
- Use of scanned artwork for fabric designing
- It can use drawings from other software’s like CorelDraw, paintbrush etc.
- Re-use of design in different hooks and picks.
- Applicable to all types of Jacquard fabrics like furnishings, curtain material necktie, dress material, towels, sarees, upholstery etc.

**CAD/CAM module for Jacquard industry**

This windows based module can be used to create all kinds of Jacquard design in any size and ends/in. and pick/in. value. This software module takes care of all aspects of designing for production of a fabric. It handles all the main issues confronting the textile Jacquard industry.

**Designing**

- We can create any type of design –from simple to intricate.
- We can start creating a new design in a blank graph paper or do editing a scanned photograph, both methods are fully supported.
- We can assign weaves to our design and get the weaved graph instantaneously.
- Sophisticated Editing Tools.
- More than 200 tools and utilities.
**Weaving Wizard Feature**

This feature results in super-fast weaving and ensures that if the user does not know about how to apply weaves, he can still weave the designs.

- Required card punching output facility.
- Float control facility—both manual and automatic.
- Any kind of new weave creation.
- Editing any existing weave.
- Mixing multiple weaves.
- Weaving storing facility—creation of custom weave library.
- Recalling a weave for further use—it saves a lot of time and labor.

**Production Output**

Different kinds of outputs according to our needs can be generated to give a design into an actual fabric shape. We can print the required output according to our need:

- Punching calculation, Punched cards and Weaved graph for jacquard card punching can also be obtained if needed.
- Electronic outputs and weave parameters—to feed electronic jacquards directly.

**Yarn Handling**

Yarn library enables us to create different types of commonly used yarns—both regular and fancy. We can store scanned yarns also and use them for viewing fabric simulation. Yarn specification like yarn count/fineness, TPI, colour and other properties can be defined while creating the yarns.

**Colour Library**

Colour library enables us to create library of our own colours and use them for viewing colour combinations. This feature facilitates:

- Making of own colour pallets
- Colour specifications.
- Saving of pallets.
- Loading of pallets.
- Editing shade numbers
• Searching for a particular colour.

**Fabric Simulation**
This feature allows us to simulate the fabric effect on woven designs. We can simulate both front and back side of the created woven design. All the settings related to simulation like yarns to be used, warp pattern, weft pattern, etc can be defined in the simulation set-up control.

**Simulation Colourways**
Colourways feature gives different colour combinations of any simulated design in both manual and auto mode. There is no restriction on the number of colours to be used. If system pallet is used, we can view the same design in 16.7 million colour combinations. In auto mode, we can view one colour combination per second. If any combination satisfies us, the automode can be paused, and after saving the combination with a name the auto mode can be resumed.

**COMPUTERIZED CARD PUNCHING**
High speed card punching machines are connected to the computer. The punches in these machines are activated electro magnetically and rate of production achieved varies 30 to 120 fully punched cards or picks per minutes.
The Ultimate in design computerization consists of direct selection of jacquard or doby needles from a simplified and condensed design through a computer. This form of control has already been introduced as electronic doby and electronic jacquards are running throughout the world.

*Computerized card punching machine*
Today, CAM type rapier looms are there which makes the production very fast and easy. These looms are designed to run without any airconditioning, thus lowering considerable amount of operating cost. Now the movement of filling insertion elements and the sley is fully controlled with the powerful mechanical system of the looms. The loom offers Electronic Take-Up (ETU) as well as Electronic Let-Off (ELO) for better controlling the tensions of the warp. The ETU along with ELO has opened up new dimensions of versatility by introducing Dynamic Pick Control (DPC). Considering the fast moving fashions in the Indian textile industry, the DPC feature allows weavers to have different pick density at any irregular intervals to give a complicated structure to its fabric. More colors can be used simultaneously in these versatile machines.