Computer-aided doby design

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Received 28 February 1989; revised and accepted 10 May 1989

An algorithm for step-by-step development of a software for the creation of doby designs is presented. The algorithm has been implemented in FORTRAN-77 and Turbopascal languages. Various drafts and peg plans have been developed and combined to arrive at different designs for doby weave.

Keywords: Dobby design, Draft, Peg plan, Software

1 Introduction

Traditionally, the woven textile designs are created on a graph paper where the designers convert the design concepts on the graph paper by the use of different symbols and colours to differentiate the nature of yarn interlacement. Today, the textile designers have to be more productive and creative due to the dynamic textile market. For this, a computer-based interactive textile designing and sample weaving system is highly beneficial to the designer.

Computer-aided designs enable the textile designer to conceive better and more patterns to suit the requirement and liking of the customers. This could not have been possible to a great extent if the same patterns were to be produced by the conventional method of designing.

Generally, computer-aided designing is associated with a system having graphic capability, which involves an additional cost. In the present work, a software that runs on a non-graphic terminal has been developed. The language used is FORTRAN-77, which is universally available on computer systems. This particular program was run on the UNIX based Micro-32 system supplied by the Electronics Corporation of India Ltd, Hyderabad. It can be implemented on other systems as well with minor modifications based on the version of Fortran used.

Apart from the above program in FORTRAN-77, a software that uses the graphic capability of a computer has also been developed. This software, developed in Turbopascal, was run on IBM PC system.

2 Materials and Methods

The development of program is based on the fundamental principle of fabric design construction. According to this principle, warps which work in different orders require separate healds, while those following the same operations of being raised or lowered are threaded through the same heald. The numbered vertical squares of lifting plan correspond with the numbered horizontal squares of the draft, indicating how that number heald is to be operated.

2.1 The Algorithm

The sequence of operations for the development of program is presented in a flow chart (Fig. 1). Based on the above procedure, the programs in the FORTRAN-77 (Fig. 2) and Turbopascal languages were developed.

2.1.1 Program in FORTRAN-77

The program developed in FORTRAN-77 was run on a Micro-32 computer system with the following specifications:
- M 68000 microprocessor
- Unix like operating system—IDRIS
- Monochrome terminal
- 1 MB memory (extensible to 16 MB)
- 2 Winchester disk drives (80 MB each)
- 2 Floppy disk drives (8 in)
- Line printer
- Dot matrix printer

In the execution of the program, the draft plan is entered in the computer in a $15 \times 40$ matrix ($NR \times NC$) and the peg plan in the $18 \times 15$ matrix ($NRR \times NCC$). These values may be changed as per the design specifications needed. The size of the matrix of design output will change accordingly.

The resulting output, using the above values of $NR$, $NC$, $NRR$ and $NCC$, is obtained in terms of the
18 x 40 design matrix in the following way:

The numbered vertical squares of peg plan (NCC) correspond with the numbered horizontal squares of the draft (NR). Thus, if the box of row number \( X \) and column number \( Y \) in a draft plan is filled, the computer will pick out all boxes of column \( X \) of peg plan and place them in column \( Y \) of design.

This completes the design output by repetitive searches for filled pixel positions in the draft. The whole design is then displayed on the monitor, based on the specific draft and peg plan. This process is made interactive on the monitor by just changing the draft or the peg plan to generate various patterns. Thus, by an input of 10 drafts and 10 peg plans, 100 designs may be generated on the computer in a very short time.

2.1.2 Program in Turbo Pascal

The specifications of IBM PC system, on which the program in turbopascal was run, are given below:

- 649 KB main memory

Program design

```
character x*1, y*1, z*1
dimension x(20,40), y(40,20), z(40,40)
open (7, file = "1", status = "OLD")
open (8, file = "2", status = "NEW")
type, 'give number of rows and col of draft'
accept nr, nc
  do 1 i = 1, nr
    read (7, 10)[x(i,j), j = 1, nc]
  10 format (40 a1)
type, 'give rows and col of peg plan'
accept nrr, ncc
  do 2 i = 1, nrr
    read (7, 10)[y(i,j), j = 1, ncc]
  20 format (40 a1)
    do 3 k = 1, nr
      do 31 = 1, nc
        if [x(k,i), eq. '*'] then
          do 4 m = 1, nrr
            z(m,i) = y(m,k)
          endif
          continue
        endif
      3 continue
      j = j + 1
    31 continue
    l = l + 1
  30 format (10 x, 'DRAFT')
    write (8, 20)
    do 5 i = 1, nr
      write (8, 100)i, [x(i,j), j = 1, nc]
      write (8, 30)
    50 format (10 x, 'DESIGN')
    write (8, 40)
    do 6 i = 1, nrr
      write (8, 100)i, [z(i,j), j = 1, nc]
      write (8, 60)
    60 format (10 x, 'PEG-PLAN')
    do 7 i = 1, nrr
      write (8, 100)i, [y(i,j), j = 1, ncc]
    70 format (10 x, 3 x, 2 x, 50 a1)write (8, 30)
      write (8, 30)
    80 format (10 x, 'PRINT')
    close (7)
    close (8)
    stop
end
```

Fig. 2—Program in FORTRAN-77

5 1/4 in. Double floppy drive
14 in. Monochrome monitor with graphics card
320 x 200 Medium resolution
Dot matrix printer

Turbo Pascal is a highly structured language in which each operation for designing has been defined in a separate procedure. The main program uses the procedures listed below:

1 Print main menu 11 Draw grid
2 Set cursor 12 Get file name
The package allows on-screen modifications in draft and peg plan by the free movement of cursor in the respective grids. The design output can be viewed at any point. There is also a facility to store and retrieve the drafts and peg plans with file names asked interactively. A main menu shows the keys defined for various operations. All other keys, that are not defined in the main menu, have no effect on the execution of the program. The same principle has been used in this program for plotting the design as in the previous program in FORTRAN-77.

3 Results and Discussion

Various dobby designs were obtained by using the above two softwares. The design outputs were visually compared and found to be exactly similar, except for a difference in printing style. In the design output of FORTRAN-77 (Fig. 3), a star represents a filled block, while in the design output of Turbopascal (Fig. 4), a filled block has been printed for the same. This is because graphic commands are not available in FORTRAN-77 language and so a block is represented as a character position or point. Similarly, the grid in FORTRAN-77 output is represented by dots, while in Turbopascal output, it is represented by solid lines.

Both the above softwares were found to be interactive in the sense that a designer can interact with the system to change the design at will on the computer monitor.

The software in Turbopascal was found to be better than that in FORTRAN-77 owing to the presence of graphic commands, making it more user-friendly and faster. The input of draft and peg plan is also easier in Turbopascal program as free cursor movement in the grid allows flexibility and easier correction of errors. While in FORTRAN-77 software, the input is given row-wise, which calls for a slight planning of the design before inputting.

The colour parameter and design simulation at a high resolution can be introduced in the Turbopascal software to analyze the actual appearance of a woven fabric.

The software developed for dobby designs may be extended further to include yarn simulation in
terms of twist angle, direction of twist and inclusion of fancy yarns.

Acknowledgement

The authors are thankful to Dr V.S. Jadeja, Design Engineer, Ahmedabad Textile Industry's Research Association, Ahmedabad, and to Profs V.K. Srivastava and V.P. Manglik, both of G.B. Pant University of Agriculture and Technology, for their interest and valuable guidance during this work.

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