Simple Graphic CAM System Controlling the Cutting Machine

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Abstract. A CAM system using a personal computer for the control of a cutting machine is described. The key part of the system is a database of suits. It contains commands that are processed by a personal computer. The computer can control a drawing or cutting machine that draws or cuts contours of style parts. The attention is focused namely to the transform of standard instructions that are understood by a tailor to commands that drive the computer.

Introduction

The standard form of a suit style is the table of instructions for drawing the style on fabrics. The suit preparation consists of following procedures: (a) scanning the dimensions of a consumer, (b) selection of a style (c) **hand** computation of points and other elements of the style and **hand** drawing the style on a fabrics (d) preparation of the first version of the suit (e) fitting the suit and correction of mistakes and (f) finishing the suit. The styles are in the form of construction tables.

The CAM system uses two databases: the database of suits and the database of consumers. The database of suits contains the list of suits prepared for the automated drawing or cutting. This means that a command file for the control of a computer exists for each such suit. The consumer's database stores dimensions and other important data of consumers. The CAM system of style preparation suppose these procedures: (a) scanning the consumer's dimensions in the case of a new consumer only, (b) selection of the style, (c) automated drawing and cutting the style and (d) hand preparation of the suit. Because the cutting procedure is automated, no errors should happen and the fitting procedure can be usually omitted.

The next advantage of the CAM system is that all existing styles can be included into it. This means that the instructions for hand drawing must be transferred into commands that are acceptable by a computer. Therefore the structure of commands is described somewhat into detail and the transform procedure is outlined in the paper. The control system is a graphic one, all

implemented graphic operations are summarized in the paper. The use of the CAM system is mentioned and some simple results are shown.

1 Instructions and Commands

The tailor draws the style according to instructions given on the paper in symbolic form with possible written explanations. The use of such instructions requires praxis, training, experience and skill, because some instructions are not defined correctly. The instructions are symbols for geometric operations, as for example creating a point of given coordinates, drawing the line defined by a point and slope, etc. A special grid coordinate system is used.

The same geometric operations can be performed by a computer, but the computer requires strictly and correctly defined commands contained in the command file. For example, the commands should contain only standard characters, no special symbols are allowed. Therefore a transform of instructions into commands is necessary for existing styles. In the case of a new style the command file can be prepared directly by the designer.

Simple examples in Table 1 help us to see the difference between instructions and commands.

Operation	Instruction	Command
Create point P11 rigth to point P1 by distance of 1.5 cm	P1 → P11 ... k=1.5	P1.sp.P11;1.5
Create line h perpendicular to line 5	5 ⊥ h	5.k.h

Table 1: Comparison of tailor's instruction and computer commands

Because the instructions are not simple in some cases and sometimes are not correctly defined, the transform cannot be automated. The transfom can be performed only by the textile specialist, because it requires experience and skill.

Command file allows us to draw all geometric objects by a computer, but the computer cannot recognize from the commands the order of connection of contour points by a contour curve. Therefore a set of contour points in a correct order should be written into a special file or at the end of the command file. It is one more requirement of the CAM system compared with hand procedure and a small disadvantage of the system. Tailor's experience and skill allow the correct drawing of the style contour from instructions in hand processing.

2 Computer Commands

Commands in the command file define the geometrical operations performed by a computer. In order to be processed by the computer, the geometrical objects and operations must be defined rigorously.

The following geometrical objects are used: point, line, circle, circular and general (Bezier) arc. Basic geometric operations can be made over the geometric objects: translation of a point, creation of a line given by a point and a slope, construction of a perpedicular line, forming a circle or circular arc customizing a general arc and finding the intersection of two lines or circles. The operator has the possibilty to create the circular arc different from default one by moving its end points and he must setup the shape of the general arc, because it is displayed initially as a line.

Three types of commands are used in the command file: (a) message, (b) definition of variables and (c) geometric operations.

Message should contain important informations for an operator or specialist, for example the name of the style.

The variables depend on consumer's dimensions and are defined by a form used in programming languages. Number of arithmetic operations is limited.

Example: Definition of the variable back shoulder depth ZH is provided by the command

$$ZH = 0.1 * VP + 0.05 * OH$$

where VP is the height of figure and OH is periphery of breast.

The command for geometric operation contains: (a) code of operation, (b) operands and (c) parameters. Operations are movement of points, creation of lines, forming of arcs etc. Operation is delimited from operands by a dot on both sides of the operation symbol. Operands are points, lines, arcs etc. They are placed before and after the operation symbol. If three operands are used, the right operands are separated by comma. In some commnds the results of operation is placed after the right arrow. Parameters are usually lengths of translations. They are separated by a semicolon and may be omitted.

Example: Instruction: "Create the point $P11$ rigth to the point $P1$ at a distance of 1.5 cm" is transformed into the command

$$P1 \text{ .sp. } P11; \quad 1.5$$

where sp it the code of opertaion (movement to the right), $P1, P11$ are operands (old and new points respectively) and value 1.5 is the parameter (distance between points).

3 Results

The CAM system performs a lot of automated operations when it runs. The system begins with reading the consumer's dimensions either from the consumer database or from the keyboard for a new consumer. Then the desired style is selected from a table of style names. The drawn style with some working points and lines appears on the screen after a short time. Now the tailor can form the arcs. For circular arcs the end points can be setup while for general arcs a lot of different shapes can be selected by moving only two control points. Finally the tailor checks the result. He can view details of styles by selecting rectangular window and zooming the contents inside it. If no mistakes are found, the style can be drawn or cut.

In the present state the system has some limitations. Only a few simple parts of the suit can be processed. There is not a possibility of cutting some parts and placing then into a new position, but procedures that perform the movement were prepared and tested. No output device is connected to the personal computer. The system version is developed namely for the help in the transform of existing styles. It contains in addition a lot of options for system performace, the detailed inspection of results and the possibility to correct errors.

Two results are shown that demonstate the possibilities of the system. A basic part of woman suit is considered. A copy of screen is in Fig. 1 and 2. Fig. 1 contains the general arc modelled by two control points displayed as crosses without symbols. A lot of different shapes can be defined. The final result is in Fig. 2. The style prepared for drawing or cutting is in the right window and the points controling the contour are in the left window.

Conclusions

The CAM system tested on simple suits has shown its possibility to automate much of tailor's work. On the other hand it requires a nonstandard and expensive output device — the drawing or cutting machine.

The main use of the CAM system can be expected in these areas. Tailors can use the system to increase the productivity of their work. Textile specialists can transform existing styles into command files and check the result by the system. The system can help in the routine parts of a new style design. The system is a suitable tool in the training of students of textile streams.

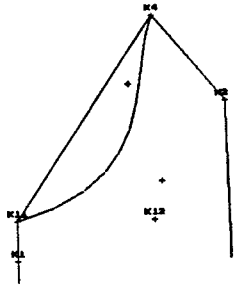

Figure 1: Forming a general arc

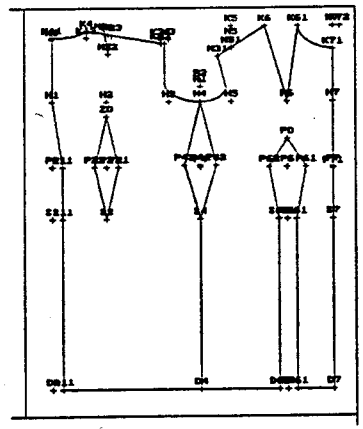

Figure 2: Final form of the style

X Window System

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Abstract

The X Window System has, over the last few years, become increasingly important and it is now accepted as *the* window system for workstations, mainframes and supercomputers. It has become the standard means of providing graphical facilities on UNIX systems. This paper gives a brief overview of fundamental principles, concepts and architecture of the X system and describes in detail essential characteristics of the X server.

Keywords

graphical user interface, window management system, X Window System, X server

1 Fundamental principles

As a visual (graphical) form of information is more natural, illustrative and understandable, intensive change to the graphical way of communication between human and computer has taken place within the past few years. The term **graphical user interface** (GUI) is used for environments, which enable this way of interaction. In addition, it makes it possible to take advantage of multitasking operating systems, such as UNIX, more effectively. The X Window System (X) represents *the* window management system, which has become standard for UNIX workstations.

1.1 X Window System

During the 1980's, the X Window System became the standard means for the development of graphical user interfaces and interactive applications with visual interfaces in UNIX. X began at MIT and its authors had defined ambitious aims, which led to advanced features and model of the system. The important reason for its acceptance was the decision to make the source code of X available free of charge. However, the X system is not public domain and is protected by copyright.