COMPUTERIZED SYSTEM AND DATABANK FOR CREATING OF WEAVE PATTERNS

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Summary

A computer aided creation- and description method is proposed for woven structures, available for any pattern. The described method is based on the computerized system developed on the Department of Textile Technology and Light Industry later on the Department of Polymer Engineering and Textile Technology. Pattern description uses symbols representing the commands of the pattern creating system, breaking with the principle of systematization of intersection points by their characters. The databank is organic part of our description method and is based on the classical system and denomination of weaves. Close contact has been created by this way between traditional and computer aided design systems and it could be applied universally to combine the pattern creation method, the pattern description method and the databank.

1 INTRODUCTION

The entire system of knowledge in study of weaves has not yet defined. Only the practical rules of basic types of weave and the less complicated patterns derived from those have been described. *Vöhringer* [1] could achieve the highest level on this field when he ranged weaves among 11 groups on the basis of their characteristics and tried to describe them through a system that used 140 marks. His method was so complicated that it could not come into general use.

The Department of Polymer Engineering and Textile Technology of the Technical University of Budapest has dealt with application of computer technique to design woven fabrics since more than a decade. The research work began with the primary patent of the Department [2], later *Való* described the possibilities offered by the computers in his doctoral thesis [3]. The first publication on the Deartment's research work [4] was followed by *Országh*'s and *Szappanos*'s diploma thesis [5] which extended this subject in the direction of practical work. Synthesis of the previous results and the development of design and description methods run within the frame of OTKA's T14191 project [6]. This lecture is the first publication of the results of this research project.

2 ALGORITHM OF THE COMPUTER AIDED WEAWE DESIGN SYSTEM

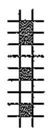
Assortment of the transfer functions is as follows: linear transfer function, sinusoidal transfer function, stepped transfer function, sawtooth transfer function, transfer values given by chart, wedge twill transfer function. At the end, by using of the additive transfer function two pattern units made by the same linear sequence unit of intersection points can be added.

Using the weave construction programme, the construction process will be described by construction commands, characters, similarly to algebraic expressions.

The programme and the describing method of weave patterns is available for modification or correction of existing patterns, for mirroring, for modification of the pattern measurements, for inversion of interlacing points and that of series of interlacing points along warp and weft ends, for addition and for combination of various weave patterns by logical operations, etc. It is suitable also to create coloured patterns or to combine various coloured patterns and for memory and disc operations. Using local databank the system is already suitable to store and to manipulate a thousand patterns at this time.

Creation of regular (simple) pattern units begins with determination of the *linear sequence unit of intersection points*, i.e. with the description of sequence of crossings where warp ends and weft ends, respectively, are on the right side surface of the fabric.

Intersection points have to be determined by the sequence of their number and quality. The most convenient method is to use the form of a fraction in which the numerator consists of number of the repeated crossings where warp ends are on the surface and the number of the repeated crossings where weft ends are on the surface is in the denominator. Under and above the numbers, respectively, there are points (·) to determine unambiguosly the sequence of the intersection points.



$$\frac{1\cdot 1\cdot 2}{\cdot 2\cdot 2\cdot}$$

Fig.1. Description of the linear sequence unit of intersection points shown on right.

Creation of weave can be made by the chosen linear sequence unit of intersection points. This can be executed by the concerning transfer function. The various transfer functions are as follows:

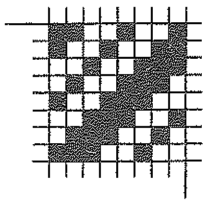
a) Linear transfer function (L):e(l) = x * i
b) Sinusoidal transfer function (S):e(i)=A sin (i * π/L)
c) Stepped transfer function (C):e(i)=y * int (i/L)
d) Sawtooth transfer function (F):e(i)=x * (i mod L)
e) Transfer values given by chart (T): e(i)= Input
f) Wedge twill transfer function (K):e(i)=Σ [xj * (i mod L)+yj] * [i^a (cj,dj)]
g) Using the additive transfer function (A) two independent pattern units, created by the same linear sequence unit of intersection points, can be added. The two pattern units should be created one after the other and the addition will be executed after pressing the ENTER key.

After choosing the transfer function the *inverse operator* appears on the screen by which inverse of any of the warp end intersection points, created by the particular transfer function, can be produced. Also *irregular patterns* can be created by this programme.

Creation of the weave, description of its preparative or executive steps can be given by activating characters. The programme offers the commands for execution of each possible steps by bold capital letters. According to this, description of the creation process can be described by these letters (see Fig. 1). The letters may be followed by ciphers in parentheses that mean the necessary values if any. For example, when using linear transfer function (L) and the value of transfer is 5, this is described by L(5).

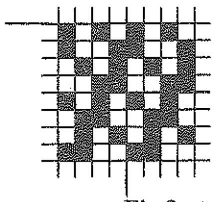
3 APPLICATION OF THE DESCRIPTION METHOD

We are showing below various combinations using the linear element of intersection points shown on Fig. 1. Using linear transfer function (symbol L) and transfer value of 2, the description for normal (Fig.2) and stepp twill (Fig3.)



$$\mathrm{TE}\frac{1\cdot 1\cdot 2\cdot}{\cdot 2\cdot 2\cdot}\mathrm{L}(1)$$

Fig.2. normal twill.



$$\mathrm{TE}\frac{1\cdot 1\cdot 2\cdot}{\cdot 2\cdot 2\cdot}\mathrm{L}(2)$$

Fig.3. stepp twill.

Wedge twill transfer function makes possible to create several kinds of weave: interrupted twill, wedge twill, leaning wedge twill.

General meaning of symbols used in wedge twill transfer function is as follows: The range of the increasing diagonal of the twill includes N warp ends (without the ones being in the breaking intersection points) and the transfer value of the next pattern unit compared to the original one is y. The total length of the two sections of the leaning wedge twill is in this case: $L=2N-y$.

The constant values of the wedge twill transfer function in case of a two-section pattern unit are:

$P(i)$ symbolizes the number of sections (i),

$x(1)$ transfer value of the linear sequence unit of intersection points along the rising section of the twill diagonal,

$y(1)=0$ means the ordinate value of the first intersection point,

$c(1)=1$ means the absciss value of the first intersection point,

$d(1)=N$ means the number of warp ends in the rising section of the twill diagonal, without the one being in the breaking point,

$x(2)$ transfer value of the linear sequence unit of intersection points along the sinking section of the twill diagonal,

$y(2) = N$ ordinate value of the first intersection point,

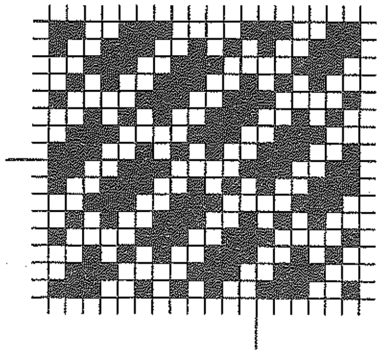
$c(2)=N+1$ absciss value of the first intersection point in the sinking section of the twill diagonal,

$d(2)= L$ total number of warp ends in the pattern unit of wedge twill.

Hence, the general form of description of weaves that may be created using wedge twill transfer function is:

P(i), [y(n), L(k)] [x(1)-y(1)-c(1)-d(1)],[x(2)-y(2)-c(2)-d(2)]
Symbol "-" is used here to separate data.

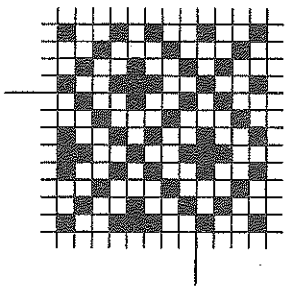
Interrupted twill can be created also by wedge twill transfer function with the following constant parameters: $P(1)$ - the transfer function consists only one section, therefore $N=L$ and $x(2)=y(2)=c(2)=d(2)=0$. *Description of the interrupted twill by using wedge twill transfer function* and data of $y=6$ and $L=3$ can be seen on Fig. 4, supposing that the linear sequence unit of intersection points is equal to that on Fig. 2:



$$TE\frac{1\cdot 1\cdot 2}{\cdot 2\cdot 2\cdot}K(1),y(6),L(3),(1-0-1-3)$$

Fig.4.

Mirroring can be used for making of many new patterns. Fig. 5 presents a crossed twill made by this method. Only one fourth of the entire pattern should be created first. We can reach the final entire pattern after encirclement of the pattern unit [M (5*5)] and modification of the intersection points on the particular warp ends (L/Sp), by mirroring to the bounding warp (TLF) and weft (TVF) ends, resp., and by annulment (D) of one bounding warp end (L) and one bounding weft end (V). Description of the pattern creation:



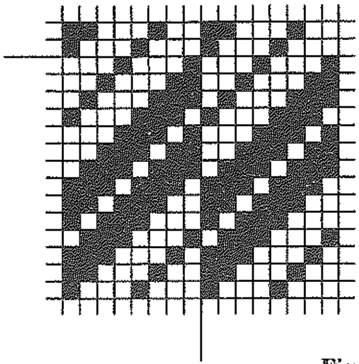
$$TE\frac{1\cdot 1\cdot}{\cdot 2\cdot 2}L(1)\cdot TME\cdot M(5*5)\cdot TVF\cdot I\cdot TLF\cdot$$

$$\cdot I\cdot K\cdot D\cdot L(9)D\cdot V(9)\cdot L(Sp):1(5);5(1)$$

Fig. 5.

Interrupted stepped twill can be created by *correction of the bounds*

Fig. 6 is presenting a multi-diagonal, stepped twill. The creation description has been specified by *linear transfer function* and the final pattern unit has been reached by modification of the original pattern unit size.



$$TE\frac{3\cdot 3\cdot 1\cdot}{\cdot 1\cdot 3\cdot 3}L(1)\cdot TME\cdot M(8*\ 14)$$

Fig. 6.

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