IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

HIERARCHY OF PLANE CONTOURS THROUGH TREES STRUCTURES WITH THE STRUCTURE LIST

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ABSTRACT

Paper presents an original method proposed by Dora Florea for hierarchy of the plane contours in trees structures, express through a structure liste, starting from the knowledge the position relation between two contours.

KEYWORDS: Plane contour, tree structure, position relation, hierarchy

INTRODUCTION

A matricial reprezentation of the trees was proposed by T.Rus [1] and so it know the reprezentation of a contours tree structure by structure list .

Requiring position relation aspect between two by two contours , belong of a contours collection defined as atomic objects expresses with the matricial reprezentation , in this paper Dora Florea propose an original method to obtain a composition structure of the tree or forest composed from atomic objects which are contours express with add the structure list.

THEORETICAL CONSIDERATION

Beeing gived the contours collection $M_c = \{C_i | i = 1..n\}$ closed and coplain, contours may be considered as the atomic objects of a complex structure of which composition may be describe by a tree or forest atomic objects. In Fig.1 it evidences an composition tree of a forest type composed from 3 disjunct trees and which it may be graphic presents as in Fig.2.

Contours structure from Fig.1 may be represents by a structure list:

$$L=(C_5(C_3(C_1),C_4(C_2),C_{12},C_6(C_7,(C_8,C_9)),C_{11}(C_{10}))) \quad (1)$$

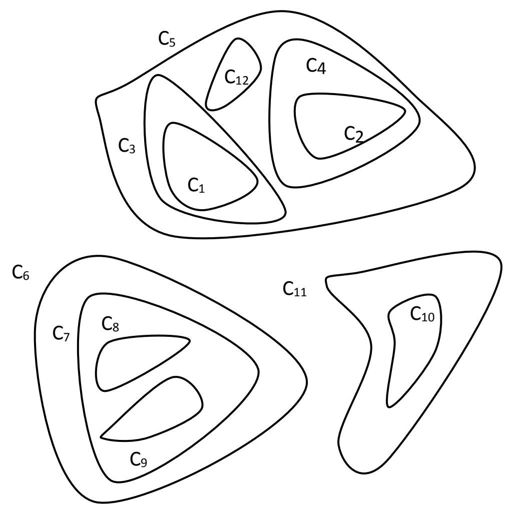

Fig.1 Contours in composition structure of tree type

Relational position aspect between two contours it defined, used the function position relation :

$$RELPOZ(C_1, C_2) \rightarrow \{INTERIOR, EXTERIOR, INTERSECTION, IDENTICAL\}$$

For the contours structure from Fig.1 , it obtain $N = n^2, n = 12$ relations which are evidenced through the table $M_{12,12}$ (Fig.3) which it note by

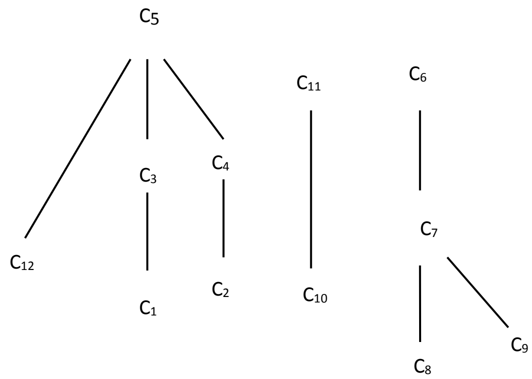

Fig.2 Graphic representation of a structure from Fig.1

1-INTERIOR relation, Blank-*EXTERIOR* relation, and with 2- *SURROUND* relation.
It make the observation that surround relation it obtain by tree rule:

$$X\ INTERIOR\ Y\ \Vdash\ Y\ SURROUND\ X \qquad (2)$$

In the Fig.2 it observed that in a tree structure it can evidence : *BRANCH* relation and *BRANCHING* relation.
Defining of relations in a tree structure [2] it make by predicative formulas (3) , with observation that from position relations mass , possible between two contours , it considers only *INTERIOR* relation:

$$R1:\ X\ INTERIOR\ Y\ \vdash Y(X) \qquad (3)$$

$$R2:\ Y(A), A(Z) \vdash Y\big(A(Z)\big)$$

$$R3:\ Y(A), Y(B), Y(C) \dots .Y(Z) \vdash Y(A, B, C, \dots .Z)$$

Table 1

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}	C_{12}
C_1	x		1		1							
C_2		x		1	1							
C_3	2		x		1							
C_4		2		x	1							
C_5	2	2	2	2	x							2
C_6						x	2	2	2			
C_7						1	x	2	2			
C_8						1	1	x				
C_9						1	1		x			
C_{10}										x	1	
C_{11}										2	x	
C_{12}					1							x

Fig.3 Relation Table $M_{12,12}$

Rule R1 from the relation (3) ,define *ARROW* notion considered as arc having as domain the knot Y and knot X as codomain.

Rule R2 from the relation (3), it is an interference rule what can be extended so:

$$Y(A), A(B), B(C), \dots X(Y), Y(Z) \vdash Y(A(B(C \dots X(Y(Z)), \dots Z) \qquad (4)$$

defining the *BRANCH* relation as the way from the knot *Y* to knot *Z* in a tree.
The number of arrows from knot *Y* to knot *Z* it names the length way and it note with $l(Y,Z)=k-1$ where k represents the number of knots belong at the some way[3].

Rule R3 from the relation (3) , which determine *BRANCHNG* rule lead at the tree definition $a=Y(A,B,C\dots Z)$ where *Y* is the root and $A,B,C\dots Z$ are under tree.

Algorithm proposed by Dora Florea in this paper,which leads at the representation of a composition structure with add of a structure list L (1) , having as the initial date the position relation of type *INTERIOR* which are between atomic elements existent in the Relation Table $M_{12,12}$ (Fig.3) , it following:

Step1. Determination of final secvent Z_i , eliminating from the symbols mass M_c , the defined elements as the fields of possible arrows in the tree $S = \{z_i | i = 1 \dots f\}$

Step2. Determination the ways from the final secvent at the initial secvent, which suppose:

2.1 To find out arrows which contain final secvent through application rule *R1*

2.2 Determination of length ways $l_i(X_i,Z_i)_{,i=1\dots f} = q$ where q is the number of arrows what contains the final secvent Z_i

2.3 Considering $\theta^i = \{x_1^i, x_2^i, \dots x_p^i\}$ symbol mass what define arrows having domains with the same codomains Z_i , it establish all arows of which domains and codomains belong mass $\theta^i \cup \{Z_i\}$.
From the observation that the initial secvent of way , represents the domain with the most codomains and in sequence if the substract the level in tree , the number of codomains it substract with 1, so last but one secvnt represents domain of a single codomain, it establish the way from initial secvent $X_j^i, j \in \{1 \dots p\}$ at the final secvent Z_i so:

2.3.1 It define the function $f\left(f_j^i\right) = m, m \geq 1$ where m is arrows number what have the same field $X_j^i \in \theta^i$

2.3.2 Sequence knots from tree in the way from X_j^i to final kot Z_i is dictate of function f , of which value descrease from initial secvent at final secvent.

So if $f(X_k^i) = m, f(X_z^i) = m-1, f(X_w^i) = 1$ $where$ $(k, z, .. w) \in [1, p]$, the way d_i in the tree is succession of secvents $X_k^i(X_z^i(\ldots(X_w^i(Z_i))\ldots) = d_i$ obtains by application of interference rule *R2*.

Step3. Determination description list of tree structure L (1):

From Step2,results relations of type $X_i(L_1), X_i(L_2), \ldots X_i(L_j)$ what describe existing ways from initial secvent X_i at final secvents.

Used the interference rule R_3 (3) what define relation of *BRANCHING*,results:

$$X_i(L_1), X_i(L_2), \ldots X_i(L_j) \vdash X_i(L_1, L_2, \ldots L_j). \qquad (5)$$

At its order each element of lists $L_{i,i=1\ldots j}$ may represents a list $L_k = X_j\,(L_{kj}), k \in [1, j]$ at which it apply the interference rule R_3 (3) if is the case.

EXEMPLIFICAION OF ALGORITHM APPLICATION

Algorithm stages traversing for example from Fig.1 exist in the Table 2 ,Fig.4, having as input dates (6) , for a particulary case, relations between eleven contours, as following application of interference rule *R1* (3) ,starting from representation of the structure presented in the fig.2:

$$C_3(C_1), C_5(C_1), C_5(C_3), C_5(C_4), C_5(C_2), C_4(C_2), C_5(C_{12}), C_6(C_7), C_6(C_8), C_7(C_8), C_6(C_9), C_7(C_9), C_{11}(C_{10}) \text{ ,} \qquad (6)$$

Table 2

Step 1 Determination final secvents : $Z_{i,i=1..6} = \{C_1, C_2, C_8, C_9, C_{10}, C_{12}\}$

Step 2. 2.1Determination arrows from (6) what contains final secvents $Z_{i,i=1..6}$

$Z_1=C_1$ $Z_2=C_2$ $Z_3=C_8$ $Z_4=C_9$
$Z_5=C_{10}$ $Z_6=C_{12}$

$C_3(C_1)$	$C_5(C_2)$	$C_6(C_8)$	$C_7(C_9)$	$C_{11}(C_{10})$	$C_5(C_{12})$
$C_5(C_1)$	$C_4(C_2)$	$C_7(C_8)$	$C_6(C_9)$		

2.2 Establish length ways $l_i(x_i, z_i)$

$l_1=2$ $l_2=2$ $l_3=2$
$l_4=2$ $l_5=1$ $l_6=1$

2.3 Determination ways $d_{i,i=1..6}$ from initial secvents at final secvents $Z_{i,i=1..6}$

Arrows $\in\{\theta^1 \cup \{Z_1\}$,where $\theta^1=\{C_3, C_5\}$, $Z_1=C_1$

$C_3(C_1)$	$C_3(C_1)$	$C_5(C_1)$	$f(C_5) = 2$
$C_5(C_1)$		$C_5(C_3)$	$f(C_3) = 1$
$C_5(C_3)$			

$$d_1 = C_5(C_3(C_1))$$

Arrows $\in\{\theta^2 \cup \{Z_2\}$,where $\theta^2=\{C_4, C_5\}$, $Z_2=C_2$

$C_4(C_2)$	$C_4(C_2)$	$C_5(C_2)$	$f(C_5) = 2$
$C_5(C_2)$		$C_5(C_4)$	$f(C_4) = 1$

$$d_2 = C_5(C_4(C_2))$$

Arrows $\in\{\theta^3 \cup \{Z_3\}$,where $\theta^3=\{C_6, C_7\}$, $Z_3=C_8$

$C_7(C_8)$	$C_7(C_8)$	$C_6(C_8)$	$f(C_6) = 2$
$C_6(C_8)$		$C_6(C_7)$	$f(C_7) = 1$
$C_6(C_7)$			

$d_3 = C_6(C_7(C_8))$

Arrows $\in\{\theta^4 \cup \{Z_4\}$,where $\theta^4=\{C_6, C_7\}$, $Z_4=C_9$

$C_7(C_9)$	$C_7(C_9)$	$C_6(C_9)$	$f(C_6) = 2$
$C_6(C_9)$		$C_6(C_7)$	$f(C_7) = 1$
$C_6(C_7)$			

$d_4 = C_6(C_7(C_9))$

Arrows $\in\{\theta^5 \cup \{Z_5\}$,where $\theta^5=\{C_5\}$, $Z_5=C_{12}$

$C_5(C_{12})$

$d_5 = C_5(C_{12})$

Arrows $\in\{\theta^6 \cup \{Z_6\}$,where $\theta^6=\{C_{11}\}$, $Z_6=C_{10}$

$C_{11}(C_{10})$

$d_6 = C_{11}(C_{10})$

Step 3 Determination describe lists of structure L :

L_1: $C_5(C_3(C_1)), C_5(C_4(C_2)), C_5(C_{12}) \vdash C_5(C_3(C_1), C_4(C_2), C_{12})$

L_2: $C_6(C_7(C_8)), C_6(C_7(C_9)) \vdash C_6(C_7(C_8), C_7(C_9)) \vdash C_6(C_7(C_8, C_9))$

L_3: $C_{11}(C_{10})$

$L=(L_1, L_{2,}, L_3) = (C_5(C_3(C_1), C_4(C_2), C_{12}), C_6(C_7(C_8, C_9)), C_{11}(C_{10}))$

Fig.4 Algorithm for the particulary case from Fig.1

CONCLUSION

Original method of Dora Florea presents in this paper through which it allow determination coplanar contours hierarchy of a mass through an tree structure expressed under structure list form is very simple.The algorithm was chack up by a program wrote in Visual Basic language.It appreciate that it necessary small input dates ,that beeing position relations of the type *INTERIOR* , identificate between the mass contors.

ACKNOWLEDGEMENTS

I take this opportunity to express my gratitude to the people who have been instrumental in the successful completion of this work.

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