

# INTERNATIONAL JOURNAL OF RESEARCH IN COMMERCE, IT & MANAGEMENT

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## IMPLEMENTATION OF SHORTEST PATH ALGORITHM FOR RECTILINEAR STEINER TREE PROBLEM

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## ABSTRACT

The rectilinear Steiner minimum tree (RSMT) problem is one of the fundamental problems in physical design, especially in routing, which is known to be NP-complete. Ant colony algorithm is a recent approach inspired by the observation of real ants and based upon their collective foraging behavior. This paper introduces rectilinear Steiner Tree problem and Ant colony algorithm as a method for computing rectilinear Steiner trees in graphs. Tree computation is achieved when multiple ants, starting out from different nodes in the graph, move towards one another and ultimately merge into a single entity. This approach is very useful to solve the routing problem in VLSI chips during fabrication.

## KEYWORDS

Rectilinear Steiner minimum tree (RSMT), routing, physical design, ant colony optimization (ACO).

## INTRODUCTION

**R**outing plays an important role in very large scale integrated circuit/ultra large scale integrated circuit (VLSI/ULSI) physical design. The rectilinear Steiner minimum tree (RSMT) problem is one of the fundamental problems in routing. Connecting a set of points in the plane with a minimal length of vertical and horizontal points are called rectilinear Steiner problem. Since timing consideration require routing path of minimal length these tree have been often used in placement and global routing phases of circuit design.

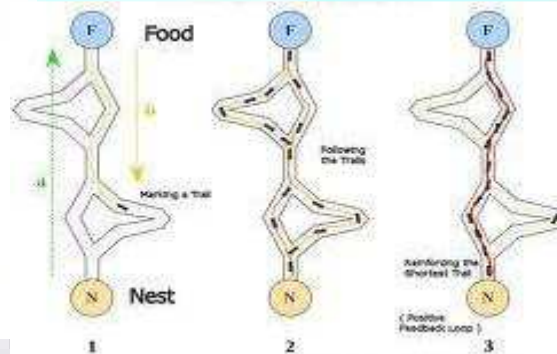
The main contribution of this paper is to propose a practical heuristic, called ACO-Steiner, to construct a RSMT, by which we can get a very short run time and keep the high performance

## ANT COLONY

Ants live in colonies and have evolved to exhibit very complex patterns of social interaction. Such interactions are clearly seen in the foraging strategy of ants. Despite the extremely simplistic behavior of individual ants, they can communicate with one another through secretions called pheromones, and this cooperative activity of the ants in a nest gives rise to an emergent phenomenon known as swarm intelligence. Ant Colony Optimization (ACO) algorithms are a class of algorithms that mimic the cooperative behavior of real ant behavior to achieve complex computations.

The ACO consists of multiple iterations. In the iteration of the algorithm, one or more ants are allowed to execute a move, leaving behind a pheromone trail for others to follow. An ant traces out a single path, probabilistically selecting only one edge at a time, until an entire solution is obtained. Each separate path can be assigned a cost metric, and the sum of all the individual costs defines the function to be minimized by ACO. Figure shown below gives the idea of ant for finding shortest path.

FIGURE 1: ANT BEHAVIOR FOR FINDING SHORTEST PATH



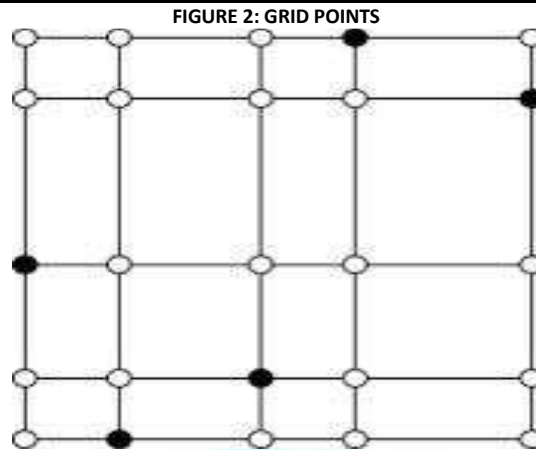
We can easily understand through the ACO algorithm which is given below:

## ACO ALGORITHM

- Initialization;
  - Keep all ants on the initial positions;
  - Set the intensity of trails as a initial value;
- While loopNum < MAXLOOP;
- Construct a complete solution by ants moving;
  - Select an ant by some rule;
  - Make decision based on trail intensity and some greedy rules;
- Update the intensity of trails based on the solution;
- loopNum ++;

## RSMT PROBLEM

A tree is said to be Rectilinear if all of its edges are horizontal or vertical. The RSMT problem is described as: Given a set  $T$  of  $M$  points called terminal in the planes, find a set  $S$  of additional points called Steiner points such that the length of a rectilinear minimal spanning tree with vertex set  $(T \cup S)$  is minimized. The construction of rectilinear tree is always performing on a rectangular surface with the help of horizontal and vertical lines called rows and columns. These horizontal and vertical lines intersect each other on a point called the grid points. So a grid points play a important role for designing the rectilinear tree.



### STRATEGIES TO SELECTING THE ANTS

There are three strategies for selecting the ants to be moved between vertices. These strategies are:

- 1. Fixed sequence strategy:** Here the ants are picked in a fixed sequence, for reassignment into a different vertex. After the last ant is moved, the algorithm is reset to pick the first, ant in the fixed sequence.
  - 2. Shuffled sequence strategy:** Here the algorithm also iterates through the ant set. However, after each ant, was moved to a different location exactly once, the algorithm shuffles the order of the ants randomly before beginning all over again.
  - 3. Random strategy:** In comparison to the other methods, this approach is the most random way to move ants. No ordering is maintained, and an ant is picked up for movement, from the set of all existing ants in a random manner with uniform probability.
- From among these strategies the Random approach gave the best results

### MATHEMATICS USED BEHIND ANT COLONY

In Ant Colony Steiner, we generate the Hanan Grid of the terminal set  $T$ . Then we place ants on each element of  $T$ . An ant  $i$  then determine a new vertex  $j$  to visit, via an edge of the Hanan grid. The choice is based on a higher value  $P_{ij}$ , which is a trade-off between the desirability and the trail intensity. Each ant maintains its own tabu-list, which records the vertices it visits to avoid revisiting them again. Then in the case where ant  $i$  meets ant  $\Omega$ , ant  $i$  dies, and adds the vertices in its tabu-list into the tabu-list of ant  $\Omega$ . After every movement of an ant the trail of the ant is also recorded in a data structure called global View. This data structure allows us to see the interaction of the ants while they are building the RSMT. Each ant in the global View data structure is identified via its identification number. Therefore, the trail of ant 2 would be displayed as sequence of 2's on the path of the trail in the global View data structure, while the trail of ant 3 would be displayed as a sequence of 3's on the path of the trail in the global View data structure and so on. At the point the ant  $i$  meets ant  $\Omega$ , ant  $i$  dies and the trail labeled  $i$  in the global View data structure would be merged with  $\Omega$ 's **trail** in the global View data structure. Thus, all  $i$  will be changed to  $\Omega$  in the global View data structure to reflect  $\Omega$ 's new trail. The trail intensity is updated at the end of each iteration of MAXLOOP. The global View data structure eventually contains the ant identification number on the trail of the only surviving ant. This identification trail is used to display the RMST before pruning.

Let  $j$  be a neighbor of  $i$  in the Hanan grid. Given an ant  $m$ , on vertex  $i$ , the desirability of vertex  $j$  is:

$$\eta_{ij}^m = 1 / [c(i,j) + \gamma \psi_{ij}^m] \quad (1)$$

where  $\gamma$  is a constant,  $\psi_{ij}^m$  is the distance from vertex  $i$  to the nearest vertex in the tabu-list of another ant. This makes the current ant join into others as quickly as possible. The superscript  $m$  is there because  $\psi_{ij}^m$  depends on the previous ant trails.

The updating of the trail intensity in the Hanan edge is defined as Follows:

$$\tau_{ij}(t+1) = (1-\rho)\tau_{ij}(t) + \rho \cdot \Delta\tau_{ij}(t) \quad (2)$$

where  $\rho$  is a constant, representing the pheromone evaporation parameter 't' which is called count, is the variable that ranges between 1 and MAXLOOP

The increments of updating are given by the following formula:

$$\Delta\tau_{ij}(t) = \begin{cases} Q/C(s(t)) & \text{if } (i,j) \in E(t) \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

Where  $C(S(t))$  is the total cost of the current Steiner tree  $S(t)$ .  $E(t)$  is the edge set of  $S(t)$  and  $Q$  is a parameter constant that specifies the amount of pheromone the surviving ant has to distribute through its trail.

The weight of an ant at  $i$  to move on edge is defined as follows:

$$P_{ij}(t) = [\tau_{ij}(t)]^\alpha [\eta_{ij}^m]^\beta / \sum_k [\tau_{ik}(t)]^\alpha [\eta_{ik}^m]^\beta \quad (4)$$

0, otherwise

Where  $A$  is the set making up of all vertices which are connected with  $i$  and  $k$  is not in the tabu-list of ant  $m$ . The parameters  $\alpha$  and  $\beta$  control the relative importance of each variable  $\tau_{ij}$  and  $\eta_{ij}^m$ .

### METHODS OF ANT COL STEINER

In this section we describe the core methods of the AntCol Steiner program. These methods are AntCol Steiner, construct Steiner Tree By ACO, Ant Move and pRune. Ant Col Steiner is used to select the best of all possible trees. Construct Steiner Tree By ACO implements the ant selection strategy and constructs the tree by merging the trails of each of the selected ants when they meet. Ant Move is used to determine which direction the ant should move via the Hanan grid. Finally, the pRune method removes all non terminal leaves from the tree obtained from construct Steiner Tree by ACO.

#### THE ANT COL STEINER (N, M) METHOD

N: This is the dimensions of a square grid.

M: This is the number of terminal points that are randomly generated and placed inside the square array.

1. BEGIN.

2.  $N$  by  $N$  array of string type is initialized with blank spaces.

3.  $M$  random vertices are generated. They have the form  $(r, c)$  where  $r$  represents row and  $c$  represents column of the grid,  $r$  and  $c$  were chosen to be even numbers so that each point in the grid was at least one space away from the other points. The only reason vertices were placed in rows  $r$  and columns  $c$  with even indexes was to make our output easier to understand.

4. At each vertex  $(r, c)$  the letter  $x$  is placed on the grid to indicate that a terminal vertex is created.

5. Using the terminal vertices a Hanan Grid is generated. During the construction of the grid each time a vertical edge and a horizontal edge crossed, the letter  $o$  is placed on the grid to represent a possible Steiner point.

6. An equal amount of pheromone is place on each edge of the Hanan Grid. This represents the initial trail intensity.



7. An ant data structure is created and M instances of the data, structure are declared and initialized. These are our artificial ants.

8. Initialize the best Steiner Tree = construct Steiner Tree by ACO (terminals, grid, intensity, grid Limits).

See the description of this method below.

9. Best S length = get T Length Q

This method gets the length of the Steiner tree just generated.

10. BEGIN WHILE

11. While (count < MAXLOOP)

• FOR each edge in the Hanan grid

- IF

The ant walked on edge of the grid during the previous iterations; update the pheromone intensity along that edge using up date Intensity (s Length, row, col, intensity)

- ELSE reduce the level of pheromone intensity.

- END IF

• END FOR

12. Steiner Tree = construct Steiner Tree By ACO(terminals, grid, intensity, grid Limits)

13. S Length = get T Length () This method returns the length of the Steiner tree just generated.

14. Indicate = choose Best Sol(best S length, s Length) returns true if old tree is still the best.

• IF (indicate)

keep the best Steiner Tree.

• ELSE

- Copy the content of Steiner Tree into best Steiner Tree.

15. Count = count+1.

16. END While

17. After MAXLOOP iterations best Steiner Tree was displayed.

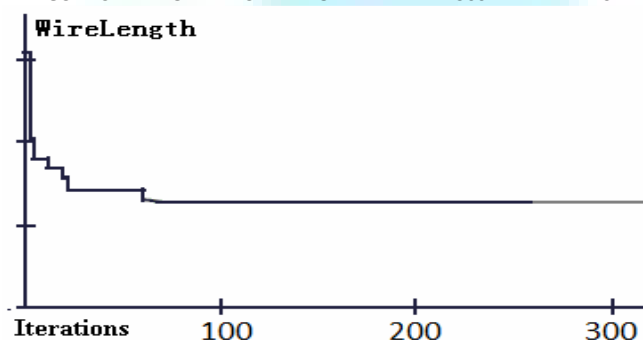
18. END IF

## EXPERIMENTAL RESULTS AND DISCUSSIONS

We have implemented ACO-Steiner algorithm in Java, and we set  $\alpha = 5$ ,  $\beta = 1$ ,  $\gamma = 1$ ,  $\lambda = 3$ , and  $Q = 10000$  in our experiments.

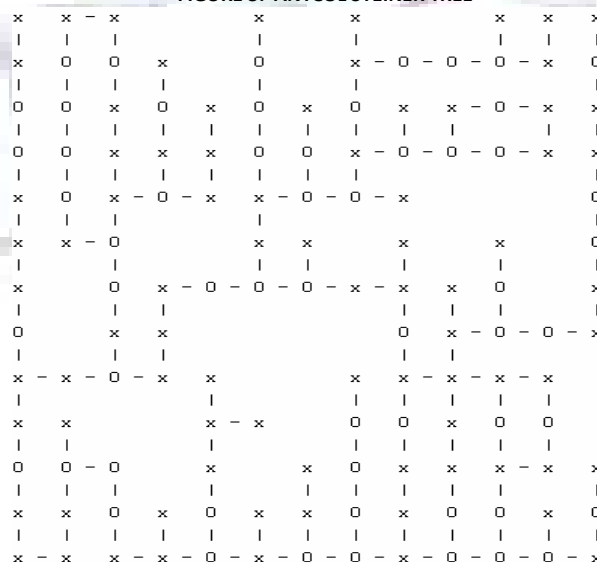
In the experiment, we find that our improvement method described in previous Section is efficient. An ant decides the next node or the edge orient greedily instead of stochastically with the possibility  $p$ . By using this "greedy approach", we can maintain a quick convergence to satisfactory solutions while keeping a good performance. Fig. shows the performance improvements in a 300 terminal RSMT instance. It shows that the algorithm get the most improvement in the first 20 iterations, and improve little after 70 iterations

FIGURE 3: PERFORMANCE IMPROVEMENT IN A 300 TERMINAL RSMT



## GRAPHICAL RESULTS OBTAIN FROM ANT COLONY STEINER

FIGURE 3: ANT COL STEINER TREE



## RESULT

TABLE 1: ANTCOL STEINER TREE RESULT

M	N	Steiner Tree Length	Execution Time(ms)
10	25	33	0.558
15	30	70	0.995
20	30	95	1.130
25	35	110	1.780
30	40	163	3.977
50	40	210	5.771
70	50	302	14.997
100	50	341	23.431
200	50	412	37.347

## CONCLUSION

We propose a practical heuristic for RSMT construction based on ACO. Then, we use a fast-ant strategy to speedup the algorithm. The experimental results show that our heuristic ACO-Steiner keeps the high performance with a very short run time.

Here we also find that there is few chances for improvement in our work. We will continue to improve performance in wire length of ACO-Steiner while keeping short run time, which is regarded as our future work.

## REFERENCES

1. D. M. Warme, P. Winter, and M. Zachariasen, "Exact Algorithms for Plane Steiner Tree Problems: A Computational Study", Technical Report DIKU-TR-98/11, Department of Computer Science, University of Copenhagen, April 1998
2. M. R. Garey and D. S. Johnson, "The rectilinear Steiner tree problem is NP-complete", SIAM Journal on Applied Mathematics, 32: pp.826-834, 1977. H. Zhou, "Efficient Steiner Tree Construction Based on Spanning Graphs", In: Proc. of ACM ISPD, Monterey, CA, USA, 2003: pp.152-157.
3. Maniezzo V, Colomi A. The Ant System applied to the quadratic assignment problem. IEEE Trans Data Knowledge Engrg 1999;11(5):769– 78.
4. Maniezzo V, Milandri M. An ant-based framework for very strongly constrained problems. In: Dorigo M, Di Caro G, Sampels M, editors. Ant algorithms— Proceedings of ANTS 2002—Third international workshop. Lecture Notes in Comput Sci, vol. 2463. Berlin: Springer; 2002. 222–7
5. Q. Zhu, H. Zhou, T. Jing, X. L. Hong, and Y. Yang. "Efficient Octilinear Steiner Tree Construction Based on Spanning Graphs", In: Proc. of IEEE/ACM ASP-DAC, 2004, Yokohama, Japan, pp.687-690.
6. S. Das, S. V. Gosavi, W. H. Hsu, and S. A. Vaze, "An Ant Colony Approach for the Steiner Tree Problem", In: Proc. Of Genetic and Evolutionary Computing Conference, New York City, New York, 2002.
7. T. Jing, X. L. Hong, "The Key Technologies of Performance Optimization for Nanometer Routing", In: Proc. of IEEE ASICON, Beijing, China, 2003, pp.118-123.
8. T. Jing, X. L. Hong, Y. C. Cai, H. Y. Bao, J. Y. Xu, "The Key Technologies and Related Research Work of Performance-Driven Global Routing", J. of Software, 12(5), pp.677-688, 2001.

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