

HEURISTIC SEARCH ALGORITHMS IN MULTI-COST
SEARCH SPACE AND THEIR APPLICATIONS TO
VLSI PARTITIONING PROBLEMS

by

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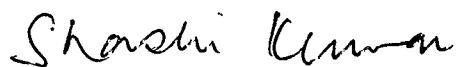
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CERTIFICATE

This is to certify that the thesis entitled, "**Heuristic Search Algorithms in Multi-Cost Search Space and their Applications to VLSI Partitioning Problems**", being submitted by Rakesh Kumar Singh to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy, is a bonafide research work carried out by him under my supervision and guidance. The results obtained in this thesis have not been submitted to any other University or Institute for the award of any other degree or diploma.



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ABSTRACT

Search is an important technique for solving problems involving multitude of exploration alternatives that might be taken to reach a solution. Many optimization problems arising in practice usually involve multiple and conflicting parameters. This thesis presents a set of heuristic search algorithms for solving combinatorial optimization problems involving multiple, conflicting parameters. We call such algorithms as multi-cost heuristic search algorithms and the space of potential alternatives to be examined as multi-cost search space.

Initially, relevant background and important contributions in heuristic search theory and algorithms are reviewed. We have considered the problem of searching for an optimal solution when the cost function is a combination of several parameters having trade-off relationships among them. We have presented an algorithm *MULT** to solve trade-off optimization problems for which there are good admissible heuristics available for each of the associated cost parameters. We have shown that *MULT** is an admissible algorithm and it has many of the important properties of the well-known single-cost search algorithm *A**.

We have considered another problem in multi-cost search space for constrained optimization in which a single objective function combining all objectives is not explicitly available. We have investigated the problem in which there is some primary objective which is to be optimized such that its optimality requirement is relaxable only within a small permissible limit. Along with meeting this objective, some other secondary parameters are to be optimized. We have presented an algorithm *MC** to tackle this problem.

We have investigated the scope of parallelism in multi-cost heuristic search algorithms and presented a parallel version of *MULT** for distributed memory multi-processor systems.

We have considered applications of multi-cost heuristic search techniques to VLSI partitioning problems. In particular, we have considered [i] network partitioning problem and [ii] partitioning of PLA based finite state machines. We have solved these problems using heuristic search techniques by mapping these problems onto search graphs by identifying problem-domain dependent search graph terms and devising admissible heuristics.

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