1 Introduction

A graph partitioning algorithm divides a problem into two or more subproblems and tries to reduce the interaction between these subproblems. Graph partitioning problem falls under the category of NP-hard optimization problem. In this project, we are presenting a convex partitioning and mapping algorithm for minimizing cut-size of partitions, for computing and minimizing longest depth of non-convex partitions and for computing longest depth of convex partitions. These problems are NP-hard problems and hence, our convex partitioning and mapping algorithm is a heuristic algorithm to obtain a good solution, or hopefully a near-optimal solution. Convex partitioning and mapping algorithm deals with the task of dividing(partitioning) a given big application graph into two or more parts such that the total number of the edges interconnecting these parts and longest depth of non-convex partitions are minimized while maintaining a given balance constraints among the part size. Convex partitioning and mapping algorithm has many important applications in VLSI design.

1.1 Related Work

Kernighan-Lin[1] proposed a two-way graph partitioning algorithm which became the basis for most of the subsequent partitioning algorithms, all of which we call the KL-based algorithms. Kernighan-Lin's algorithm (KL algorithm) works only on balanced partitions, and performs number of passes over the cells of the circuit until it finds a locally minimum partition. Each pass consists of a repeated operation of pairwise cell swapping for all pairs of cells. Fiduccia-Mattheyses[2] proposed a faster implementation of KL algorithm. FiduccíaMattheyses' algorithm (FM algorithm) can operate on unbalanced partitions provided that the part sizes satisfy a particular balance constraint. They also proposed a single cell move instead of a swap of a cell pair at each step in a pass. These modifications as well as proper data structures, like bucket lists, reduced the time complexity of a single pass of KL algorithm to linear in the size of the circuit (the number of pins). Since real circuits are usually very big, KL algorithm is not very efficient for practical use because of its high time complexity, and so the partitioning algorithms proposed after FM algorithm have utilized all the features of FM algorithm. Sanchis[4] proposed a multiway circuit partitioning algorithm based on Krishnamurthy's[3] algorithm so that it could handle the partitioning of a circuit into more than two parts. All the previous approaches before Sanchis' algorithm (FMS algorithm) are originally bipartitioning algorithms. Our proposed convex partitioning and mapping algorithm for graph partitioning is based on FMS algorithm and convexity of graph. Our actual

problem is to partition a given application or big graph according to the size of a small resource graph such that each partition is covered by the resource graph. In FMS algorithm, balance criterion of size of partitions state that size of each partition should be in a close integral range. But, we have adopted the balance criterion that allows the size of each partition within interval [0, n'], where n' is total number of nodes present in resource graph R(V', E').