Floorplanning and Placement in VLSI Circuits

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Abstract

Continuous decrease in feature size along with rapid increase in number of components in modern integrated circuit designs are factors which mark the progress of modern very large scale integration technology. Floorplanning is an important stage of physical design which has been extensively studied in the past. But new architectures, ever evolving algorithms and new objectives have kept the research in this field continuously relevant. Modern floorplanning needs to consider objectives like fixed outlines, chip temperature, power, power routing resource, voltage drop etc. Moreover modern architecture is no longer limited to 2- dimensional representations. Rigorous research is being performed to generate tools for 3- dimensional Integrated Circuit representations which support heterogeneous integration with reduced cost metrics.

The proposed work deals with the creation of fixed outline floorplanning with the objective of generating layouts within a fixed outline with predefined dead space along with considerations of wirelength minimization, which is an important cost metric. As per demand of the floorplan generation in nano-scale era, chip temperature is an important objective directly affecting the performance and reliability of the device. Apart from the above objectives, important cost factors of power minimization in multiple supply voltage domain and power routing resource to simplify power planning, along with voltage drop are also considered. Finally, stacked 3-D layout considering through-silicon vias(TSVs) as a cost metric is also considered.

Various approaches have been used to solve the floorplanning problem. The novelty of the work lies in the use of a large number of unique

heuristics along with a SAT(Boolean Satisfiability) based framework to generate a floorplan optimizing the various objectives mentioned above. The proposed work has been experimentally validated on standard floorplanning benchmarks of MCNC and GSRC where the proposed approaches have performed very well.