Abstract

The *channel routing problem* is the problem of providing interconnections for all circuits attached to the periphery of the modules flanking a rectangular channel such that the total area of routing within the channel is minimized. This thesis is an in-depth study and investigation into channel routing using multiple layers of interconnection in the alternating reserved multi-layer Manhattan routing model for both no-dogleg routing as well as restricted dogleg routing. We consider minimization of cost factors such as the total area of routing and the total wire length required for routing. We study the computational complexity of several problems of minimizing the total area and the total wire length in multi-layer channel routing and establish NP-hard intractability results. We propose efficient polynomial time heuristics for solving several such NP-hard problems. The design of algorithms and the results on NP-hardness, follow a uniform strategy for representing and interpreting the horizontal and vertical constraints. Within the same framework we establish the NP-hardness of absolute approximation of area minimization in two- and three-layer channel routing. We also design a polynomial time algorithm for computing a new lower bound on the number of tracks required for routing a given channel.

Key Words: Multi-Layer Channel Routing, Reserved Layer Manhattan Routing Model, Horizontal Constraints, Vertical Constraints, No-Dogleg Routing, Restricted Dogleg Routing, NP-Hardness, Lower Bound, Absolute Approximation, Channel Area, Wire Length.