Master thesis of *Mao-Chieh Chang*

On Solving the Minimum Cost Order Allocation Problems- A Case Study of IC Design House

Mao-Chieh Chang

Department of Industrial and Information Management (Executive Master)

National Cheng Kung University

This thesis seeks an optimal order allocation in a supply chain network for an IC design house at Taiwan. The supply chain network is composed by layers of single commodity networks, where each layer network represents possible manufacturing processes and connections between eligible companies for manufacturing a single product. The current practice usually results in an ineffective solution since it is based on negotiation between the procurement staff and production control staff without integrated information in the costs, qualities and capacities of manufacturers.

Here we treat the entire manufacturing supply chain network as a multicommodity network flow network. We formulate an integer linear program which involves flow balance constraints to receive and ship materials and products, individual or integrated quality requirement constraints for manufacturing, and manufacturing lower bound and capacity constraints for eligible companies. An integer flow variable is associated with each arc to represent orders shipped between companies. This problem is NP-hard, and we solve it by a state-of-the-art optimization solver on a PC.

Our mathematical model is easy to use. We have tested it on real-world data obtained from an IC design house for LCD. We also conduct sensitivity analysis to see the impacts of changing the capacity, manufacturing cost, quality requirement, manufacturing lower bound for each order, and adding or removing a company in the supply chain network. We conclude that our mathematical model is very useful to the semiconductor industry.

***Keywords*:** IC design, Order allocation, Outsourcing, Integer linear program, Minimum cost multicommodity network flows

Thesis advisor: *I-Lin Wang,* ilinwang@mail.ncku.edu.tw
http://ilin.iim.ncku.edu.tw
***Mao-Chieh Chang* entered the executive master's program of IIM at NCKU in 2012, graduated in 2015.**