

Integration of Demand Planning and Manufacturing Planning

Task Leader

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Primary Anticipated Result

This task will develop analysis and planning methodologies for integrating demand planning, product mix planning and tool portfolio planning in semiconductor manufacturing network. It will enhance the robustness of demand modeling and support business planning by integrating capacity allocation of multiple technological generations of product demands, processes and tools.

Task Background

Product, process, and tool technologies change rapidly in the semiconductor industry. Multiple generations of technology usually coexist in a wafer manufacturing plant. The mismatch between product requirements and the right capacity is a major cause of operation inefficiency and long cycle time. In the post-PC era, product types will proliferate; the importance of capacity allocation will increase; from a business perspective, demand planning must be fully integrated with capacity planning in order to cope with the market dynamics. The first task of this project will address the issue of demand modeling. This task will further enhance the utility and robustness of demand models by taking into consideration the characteristics and constraints of tool and process portfolios. In previous work, we have developed models of product mix and tool portfolio planning (*IEEE Transactions on Semiconductor Manufacturing*, 8/2000, pp. 278-285). In this task, demand models will be built on top of those models to determine optimal allocation of capacity under varying scenarios of demand. Planning methodologies and models will also be developed to support business and demand planning. This task will improve OEE, responsiveness to business changes, cycle time and bottleneck utilization, as outlined in the technology roadmap (NTRP).

Research Description

The issues to be investigated are: 1) granularity of capacity analysis, 2) integration of product demand models with process and tool portfolio models, and 3) business and demand planning under changing technology environment. In previous studies, we have developed static capacity models and queuing capacity models for wafer manufacturing plants (*International Symposium on Semiconductor Manufacturing*, 1999, pp. 11-14 and pp. 19-22). These models will be used to study and improve the robustness of planning horizon, granularity, and characterization of demand models. Technology attributes will be used as the common thread to integrate capacity analysis, demand forecast, and process capability based on demand representation models developed in Task 1. The goal is to quantitatively construct the relationships between demand representation and factory capacity (at the tool and process capability level) to enhance demand modeling.

In our previous work, we have shown that the fab capacity is dependent on both

product mix and tool portfolio. In this study, demand models and process and tool portfolio models will be parameterized using technology attributes and then integrated into a coherent planning model. The model will provide predictive performance information of throughput, cost, and cycle time for changing technological and business scenarios. The scope of this project covers the semiconductor manufacturing network. We have developed capacity models for wafer fabs. In this task, we will also develop capacity models for other stages of semiconductor manufacturing, including probing, assembly and final test.

The third issue builds on the research results achieved on the first two issues. Business planning utilizing the integrated portfolio model will be demonstrated. Given a current technology and capacity portfolio, the best opportunity in terms of satisfying market demands will be determined. Given a demand forecast, the best technology and capacity strategy will be determined.

Deliverables for transfer to industry

Capacity granularity analysis and aggregation method (Model, Report) (DEC-01)

Integrated demand, process, tool and capacity allocation methods (Model, Report) (DEC-02)

A framework of business and demand planning (Model, Report) (DEC-03)

Graduate Students (if known)

TBD (1 Ph.D. and 1 M.S. students)

Industrial Liaisons

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