Paper on Scope Industrial Applications of Optimal Scheduling Models

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Scope for Industrial Applications of Optimal Production Scheduling Models

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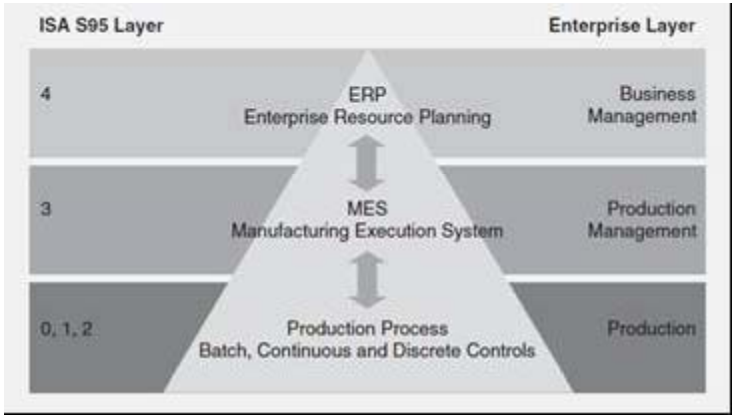
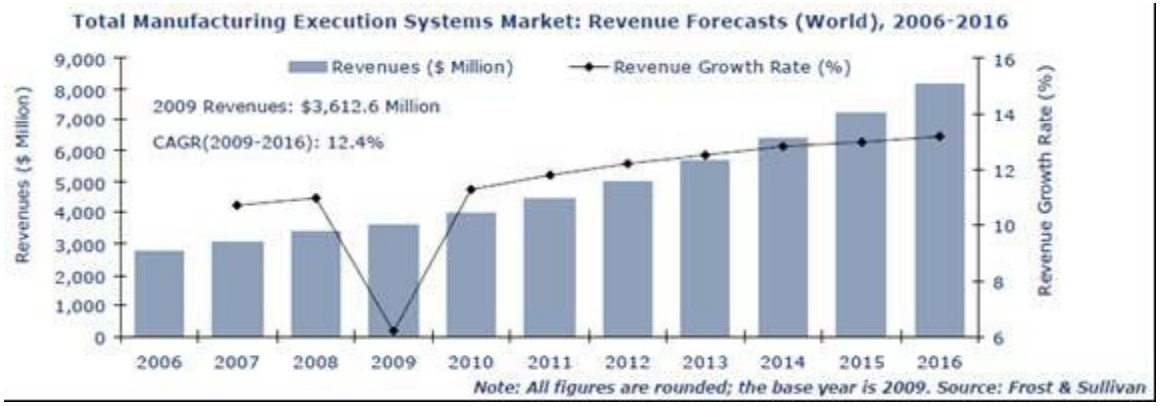
Target: Identify industrial applicability of existing scheduling solutions and provide some ideas or guidelines on how the gap towards industrial applicability can be reduced or even closed

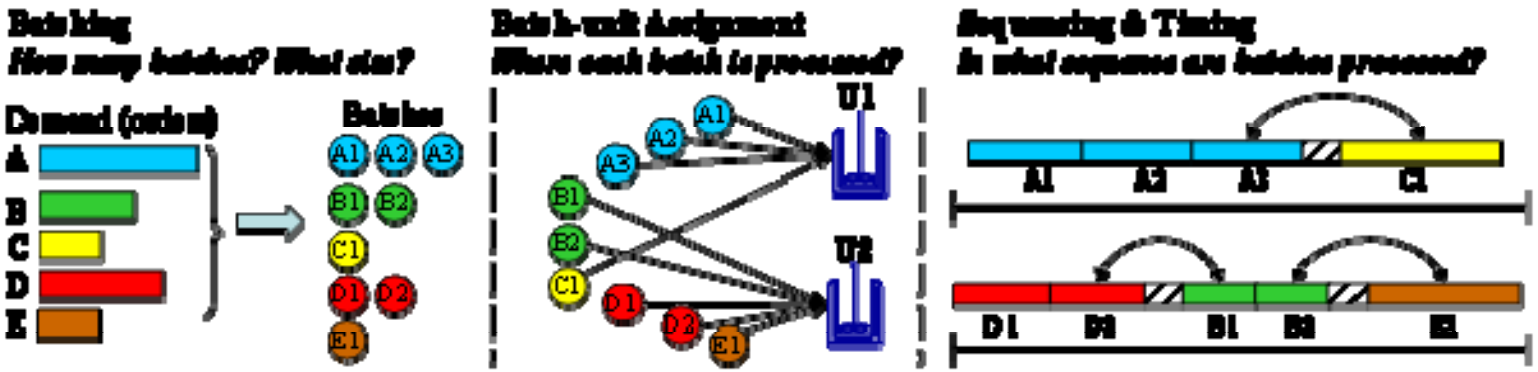
1. Introduction, motivation





Expected growth of MES systems – partly driven by optimization-based scheduling

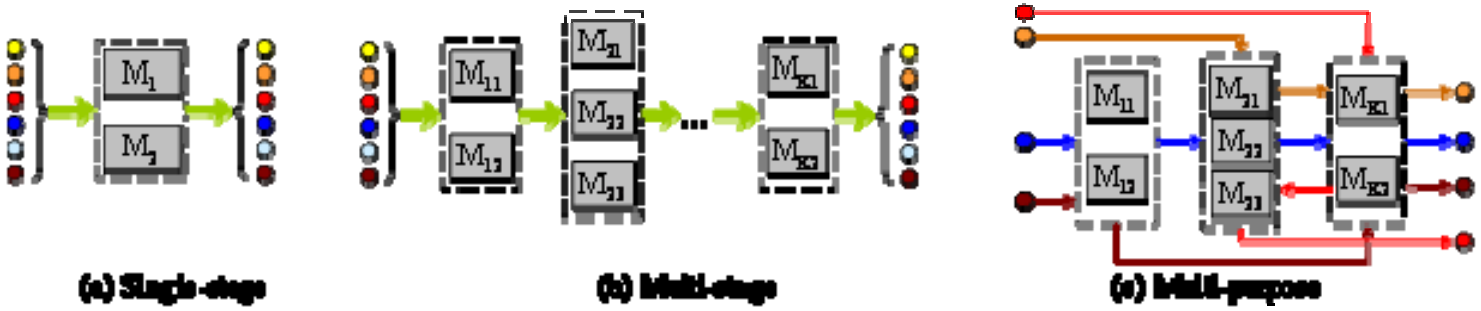
2. Major classes of Production Scheduling Problems



2.2 Market environment: Make to stock make to order

2.3 Planning functions (push vs pull policies)

2.4 Production facility



2.5 Processing features and restrictions

2.6 General resource constraints

2.7 Set-ups

2.8 Material storage and transfer

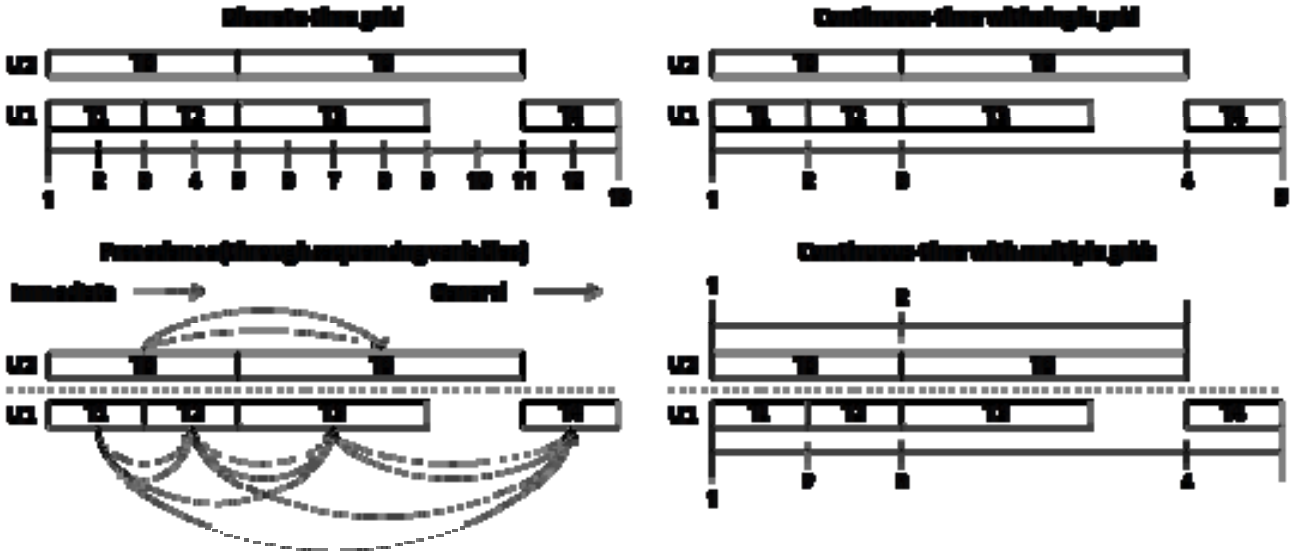
3. General versus Specific Approaches to Production Scheduling

Tailored vs generic commercial

TSP vs STN, RTN models

4. Major scheduling models

4.1 Linear scheduling models



4.1.1 Continuous-time with general precedence sequencing variables
4.1.2 Linking the RTN process and mathematical models
4.1.3 Discrete Time
4.1.4 Continuous-time with single time grid
4.1.5 Continuous-time with multiple time grids

4.2 Nonlinear scheduling models

Process models (eg blending)

5. Solution Methods

5.1 MILP Methods

5.2 MINLP Methods

5.3 Math programming enhancements
- **5.3.1 Problem representations and modeling methods**
- **5.3.2 Valid inequalities and extended formulations**
- **5.3.3 Branch-and-bound algorithm**
- **5.3.4 Decomposition algorithms**

5.4 Constraint Programming

5.5 Heuristic and Metaheuristic Methods
- **5.5.1 Rule-based scheduling**
- **5.5.2 Decomposition-based approaches**
- **5.5.3 Meta-heuristics**
- **5.5.4 Heuristics-guided exhaustive search by reachability analysis of timed automata**

5.6 Hybrid Methods

5.7 Methods for Uncertainty

5.8 Overview Modeling Systems (GAMS, AIMMS, AMPL)

6. Comparison, deployability

6.1 Deployment aspects

6.2 Academic Research

6.3 Industrial Most Successful Applications

6.4 Arising industrial problems

6.5 Lessons learned from successful industrial implementations

- 6.5.1 Role of the production scheduler
- 6.5.2 Information available to the production scheduler
- 6.5.3 Day-to-day production scheduling
- 6.5.4 The business opportunity in improved scheduling
- 6.5.5 Elements of successful implementation
- 6.5.6 Summary

7. Critical Review - Challenges

8. Conclusions and future directions

Appendix A. Primer on Solution Methods
Appendix B. Basic Formulations

Any comments or suggestions?