

THESIS PROPOSAL

Title

Robust Production Planning under Supply Timing Uncertainty

Main topic

Production Planning refers to the allocation of operative tasks and tools to machines to produce parts. A significant aspect that is often not considered in the literature is the raw materials' lead times and delivery punctuality, which may cause a postponement of the final product's delivery compared with the predefined production plans, with a direct impact on the company's competitiveness in the market.

Manufacturing companies and especially ETO companies delivering highly customized products typically request raw materials with strictly defined specifications and start the production only after that all the details of the order have been agreed with the client. Therefore, the lead time defined by the supplier directly affect the performance of the company, since the operations cannot start until the arrival of materials.

In planning problems, uncertainty on the data typically requires the application of a robust optimization approach. This thesis proposes a robust formulation of a production planning problem, to evaluate the optimal solution in the presence of a given number of fluctuations of the actual materials delivery time with respect to the nominal one. Previous research shows that it is possible to exploit recently developed mathematical approaches (e.g., cardinality constrained approach) to derive the bounds of a general linear programming solution.

The industrial problem is taken from a real production environment, in the context of a research project.

Main steps of thesis development

- Problem definition. Study of the deterministic version.
- Literature review: analysis and comparison of existing techniques
- Development of the robust version of the approach.
- Visits to the company's production site. Collection of data from both the client and its suppliers.
- Testing and Validation within the real industrial case.

Skills required: Programming languages (Matlab, Python, or equivalent), Design of Experiments.

Candidate to 7-point thesis: YES

Effort estimation: 8-month full-time

Location: Milano, Italy

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References

Lugaresi, Giovanni. "The cardinality-constrained approach applied to manufacturing problems." (2016). M.Sc. Thesis: Politecnico di Milano.

Lugaresi, Giovanni, et al. "A robust cardinality-constrained model to address the machine loading problem." *Robotics and Computer-Integrated Manufacturing* 62 (2020): 101883.

Pinedo, Michael L., *Scheduling: Theory, Algorithms, and Systems*, Springer Verlag; 5th edition, 2016.