

Tactical Allocation of Machining Resources in Make-to-Order companies with Functional Workshops: Mathematical Modeling, Analysis, and Case Study

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Abstract

Allocating resources effectively among competing activities is a crucial optimization problem in numerous domains, including manufacturing, healthcare, and finance. Manufacturing, Planning, and Control (MPC) have garnered significant interest from practitioners and operations research experts alike, as it has shown a positive impact on efficiency for companies worldwide. This talk focuses on the tactical resource allocation problem (TRAP) within the context of a multi-item, multi-level, capacitated production planning problem for GKN Aerospace, our case company. The objectives (often conflicting and with no a priori preference) pursued are minimizing resource loading beyond a predefined threshold, qualification costs, and inventory costs. The two main partners in this research are Chalmers University of Technology and GKN Aerospace AB, and for one of the papers we collaborate with Fraunhofer-Chalmers Center for Industrial Mathematics in Gothenburg, Sweden. I mainly present two of my works.

The first work involves the development of a deterministic bi-objective discrete optimization model and a specialized solution approach (<https://doi.org/10.1111/itor.13180>), while the second work addresses a robust bi-objective optimization model with uncertain qualification costs (<https://doi.org/10.1007/s10458-022-09564-8>). Mathematical properties of the model formulation will be discussed, along with computational results highlighting the efficacy of the proposed approaches. Furthermore, if time permits I will also provide some details of my recent work where we incorporate a third objective of inventory cost and develop a criterion space decomposition approach to solve this tri-objective discrete optimization problem effectively (<https://doi.org/10.1007/s10287-023-00442-6>).