

## **Factory Optima: A Web-based System for Composition and Analysis of Manufacturing Service Networks based on a Reusable Model Repository**

This paper reports on the development of Factory Optima, a web-based system that allows manufacturing process engineers to compose, optimize and perform trade-off analysis of manufacturing and contract service networks based on a reusable repository of performance models. Performance models formally describe process feasibility constraints and metrics of interest, such as cost, throughput and  $CO_2$  emissions, as a function of fixed and control parameters, such as equipment and contract properties and settings. The repository contains performance models representing (1) unit manufacturing processes, (2) base contract services, and (3) a composite steady-state service network. The proposed framework allows process engineers to hierarchically compose model instances of service networks, which can represent production cells, lines, factory facilities and supply chains, and perform deterministic optimization based on mathematical programming and Pareto-optimal trade-off analysis. We demonstrate Factory Optima using a case study of a service network for a heat sink product which involves contract vendors and manufacturing activities, including cutting, shearing, Computer Numerical Control (CNC) machining with milling and drilling operations, quality inspection, finishing, and assembly.