MODAPTO [101091996]: Modular Manufacturing and Distributed Control via Interoperable Digital Twins

5.4.2 Integer and Linear Programming

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Integer (IP) and Linear Programming (LP) represent the most widely applied exact method for production scheduling optimization, especially when the goal is to find optimal solutions under a set of constraints. LP models are suitable when decisions can be represented using continuous variables, such as quantities or time durations. However, most scheduling decisions involve discrete choices-like assigning tasks to machines or determining the order of operations. This leads to the use of integer programming or mixed-integer linear programming (MILP), where some variables must be integers and others can be continuous.

MILP modeling combines both continuous and integer variables, making it well-suited for scheduling problems that mix timing decisions with task allocation. In typical scheduling models, binary variables indicate whether a job is assigned to a machine or positioned in a specific sequence. MILP models are used to minimize common performance indicators such as total completion time, lateness, or other measures introduced in earlier sections. While these models can become computationally intensive as problem size grows, advances in solver technology and modeling techniques continue to improve their applicability in practical scheduling tasks.

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