



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



5.3.2. Machine Properties

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Machine properties represent the operational characteristics that directly influence scheduling decisions. These properties may include setup times, processing times and availability. Each of these properties introduces constraints that must be appropriately managed to achieve efficient production.

Setup times refer to the periods needed to prepare a machine for processing a new job. These can be either sequence-independent, where the duration is constant regardless of job order, or sequence-dependent, where the time required depends on the specific sequence of jobs. Sequence-dependent setups can significantly affect scheduling outcomes, as the order of jobs directly influences total setup time.

Processing times define how long a machine takes to complete a given task. In practice, these times often vary due to factors such as material differences, operator skill, or machine environment (as already discussed). Some machines perform certain operations faster, while others may offer more flexibility or precision. Scheduling systems must account for this variability to allocate tasks effectively and maintain stable production flow.

Machine availability includes both planned unavailability, such as maintenance breaks or shifts, and unplanned disruptions, such as breakdowns or quality issues. Managing availability requires accurate planning and the ability to respond to unexpected changes. This might involve rescheduling tasks, assigning them to alternative machines, or using historical data to anticipate disruptions.

Other important machine properties may also affect scheduling. These include machine capabilities, tooling constraints, energy consumption, and intermediate buffer capacities. Each of these factors can impact how tasks are assigned and sequenced, and must be considered when designing robust and realistic scheduling solutions.

References

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