FLOWOPT: BRIDGING THE GAP BETWEEN OPTIMIZATION TECHNOLOGY AND MANUFACTURING PLANNERS

Motivation

- help small and medium enterprises (SMEs) to optimize their production
- Why?
  - increasing competition from low wage economies
  - existing optimization practice no more feasible
  - existing tools too expensive and to rigid
- SMEs specifics
  - connected to area of origin (no move elsewhere)
  - high variety of products (no mass production)
Our approach

- Be close to the customer
  - use notions that factory planners are familiar with
- Translate the problem to solving formalism
  - use flexible modelling and solving approach
- Solve the problem to acceptable quality
  - combine heuristics and inference
- Allow customers to modify the solution
  - support interactive changes of solutions

The problem

- Real-life production scheduling with alternative process routes and earliness/tardiness cost.
- Involves planning (selection among alternative processes) and scheduling (time and resource allocation).
Background

- **Workflow** is a description of manufacturing process (how to produce a given item)
  - activities and relations between the activities
    - we use DAG to represent workflows
      - nodes – activities
      - arcs – precedence constraints
  - specific nested structure with alternative branches

FlowOpt system

- **FlowOpt** tools build on top of enterprise optimisation system MAK€ for SMEs
  - build-to-order (engineer-to-order) production
  - on-time-in-full objective (earliness/tardiness)

- The system supports the following tasks:
  - interactive graphical design of workflows
  - creating and scheduling custom orders
  - visualisation and modification of schedules
  - schedule analysis
**FlowOpt design process**

- Workflow editor
- Optimizer
- Analyzer
- Gantt Viewer

*Workflow editor*

- top-down and bottom up approach to design **nested workflows**
- supports **extra logical** (mutual exclusion, …) and **temporal** (synchronization, …) **constraints**
Optimiser

a fully **automated scheduler** that takes description of workflows for ordered products and generates a schedule

- implemented in ILOG CP Optimiser (OPL Studio)
- branch-and-bound optimisation (earliness and lateness costs and cost for alternatives are assumed)

Gantt Viewer

- visualization and modification of schedules
Analyser

- analysis of problems in schedules (late deliveries) and suggestions for enterprise improvements (buying a new resource)

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