Coping with Uncertainty in Project Scheduling: New Developments and Applications

Rolf H. Möhring
Technische Universität Berlin.

November 3, 2009

Abstract

Combinatorial optimizers have recently become more aware about the influence of uncertainty and randomness in solving combinatorial optimization problems. Deterministic models for project scheduling and control suffer from the fact that they assume complete information and neglect random influences that occur during project execution. A typical consequence is the underestimation of the expected project duration and cost frequently observed in practice.

To cope with these phenomena, we consider scheduling models with random processing times. Scheduling is then done by policies which consist of an an online process of decisions that are based on the observed past and the a priori knowledge of the distribution of processing times.

I will first give an informal survey of recent results for this model, including risk measures for the makespan distribution and approximation algorithms for policies in machine scheduling.

I will then then continue with an application to turnaround scheduling. This concerns large-scale maintenance in industrial plants and requires the shutdown of entire production units for disassembly, comprehensive inspection and renewal. It is an important process that causes high out-of-service cost. Therefore a good schedule for a shutdown and and an analysis of possible associated risks are crucial for the manufacturer.

We have developed algorithms for this task that work in two phases. The first phase supports the manager in finding a good makespan for the shutdown. It computes an approximate project time cost tradeoff curve together with a stochastic evaluation of the risk for meeting a particular makespan t. Our risk measures are the expected tardiness at time t and the probability of completing the shutdown within time t. In the second, detailed planning phase, we solve the actual scheduling optimization problem for the makespan chosen in the first phase heuristically and compute a detailed schedule that respects all side constraints. Again, we complement this by computing upper bounds for the same two risk measures, but now for the detailed schedule.