Hoist scheduling problem

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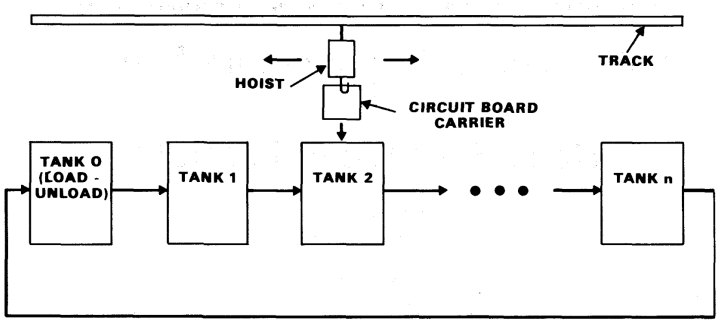
Introduction

- **Problem description**
  - Typical application: electroplating lines
  - Hoists move carriers from tank to tank
  - Carriers are soaked in the tanks
  - Soaking times must be held within prescribed limits
- **Cyclic-HSP (CHSP)**
  - Carriers are moved between tanks by preprogrammed hoists
  - After each cycle the same system state is reached
  - Introduction of a new carrier into the system $\rightarrow$ new cycle
  - Objective: maximize the throughput of the system

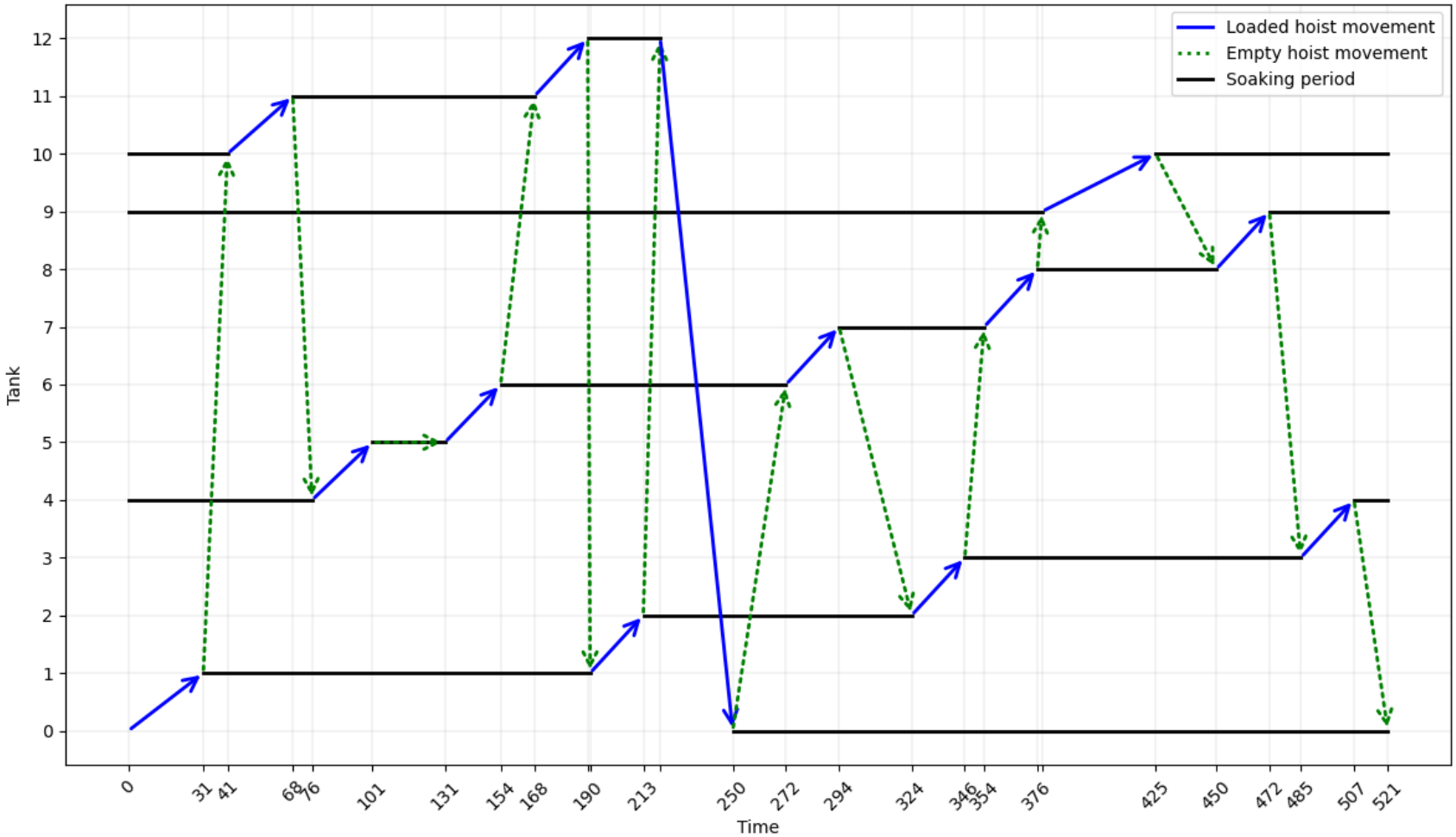


Single-hoist CHSP setup

Solution method - MIP formulation

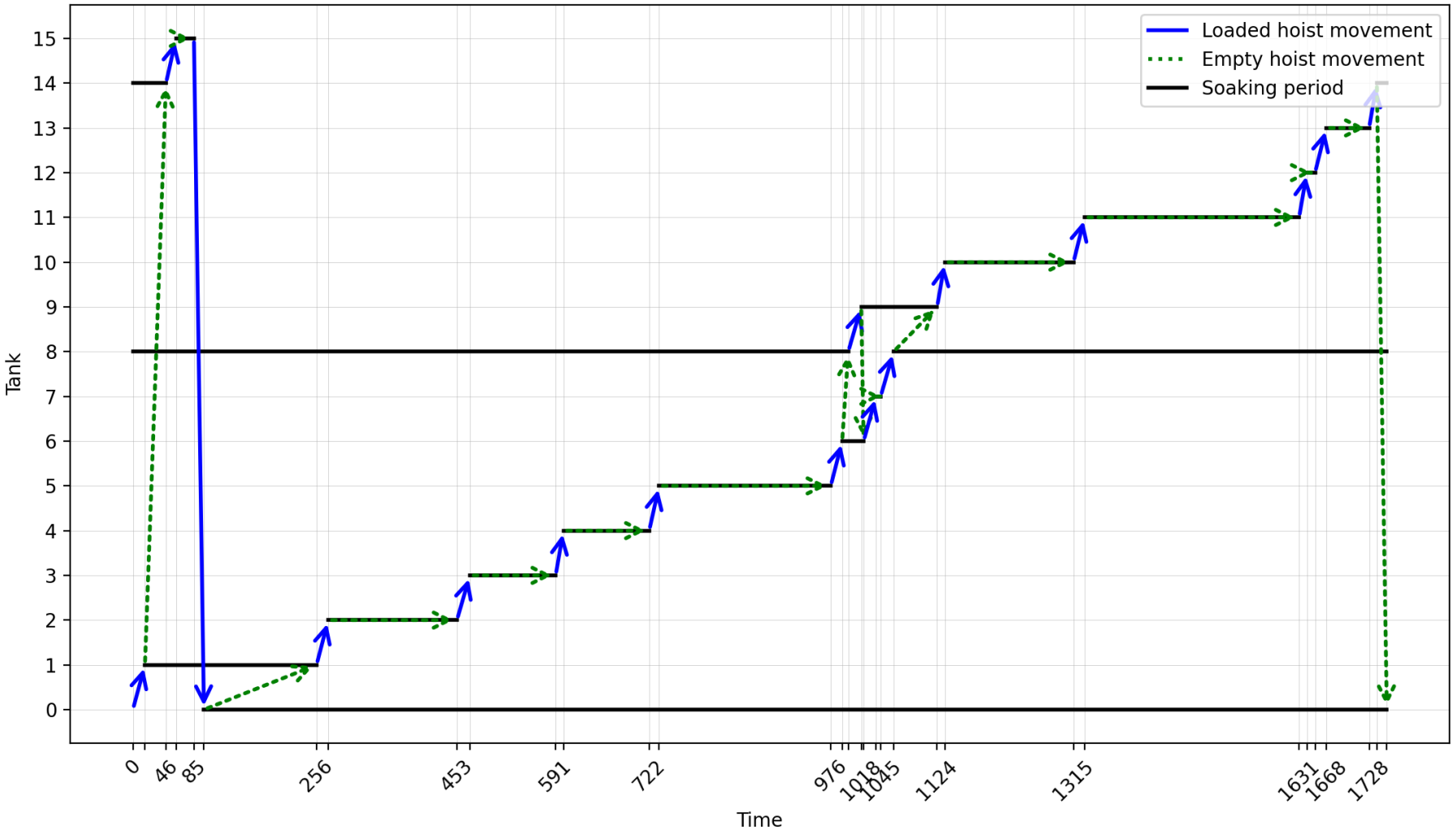
- Want to find the optimal removal time for each tank
- Constraints ensure:
  - no two carriers occupy the same tank at any time
  - no two moves are done simultaneously
  - the hoist has enough time to travel
  - soaking times are within the given boundaries
- Calculate entry times

Implementation and examples



solution of 12 tanks example

Implementation and examples



solution of 15 tanks example

Directions for further study

- Single-hoist case
  - multi-purpose tanks
  - duplicated tanks
- Multi-hoist case
  - multiple-hoist on a single line
  - collisions must be avoided

References

- Phillips, L. W., and P. S. Unger. “Mathematical Programming Solution of a Hoist Scheduling Program.” A I I E Transactions 8 (2): 219–25. (1976).
- Emna Laajili. Modélisation et algorithmes pour le dimensionnement et l’ordonnancement cyclique d’atelier de traitement de surface. Automatique / Robotique. Université Bourgogne Franche-Comté, (2021).
- Manier, Marie-Ange, and Christelle Bloch. "A classification for hoist scheduling problems." International Journal of Flexible Manufacturing Systems 15.1: 37-55. (2003).

Thank you for your kind attention!