

Nesting and scheduling problems in additive manufacturing: a decomposition approach



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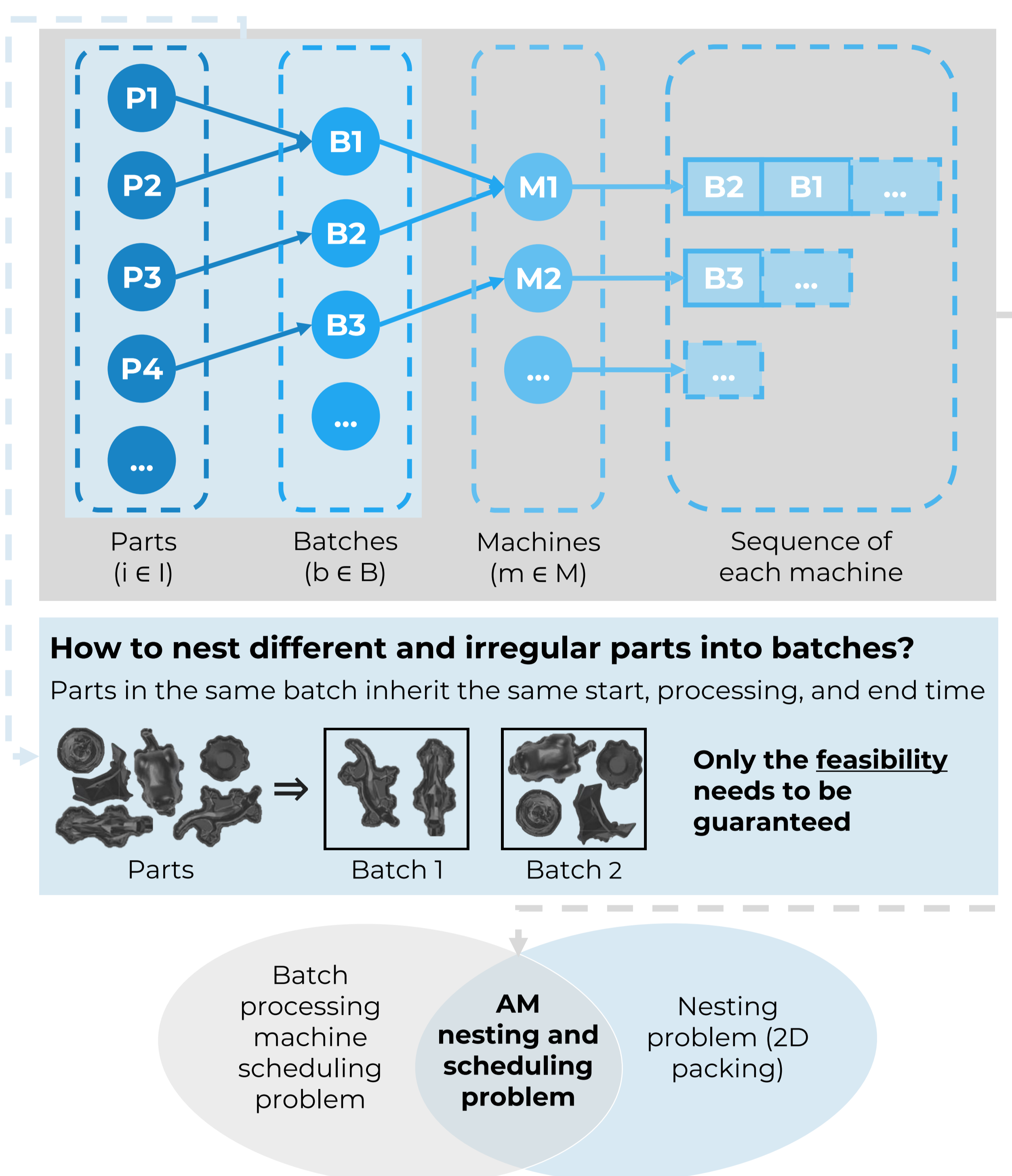
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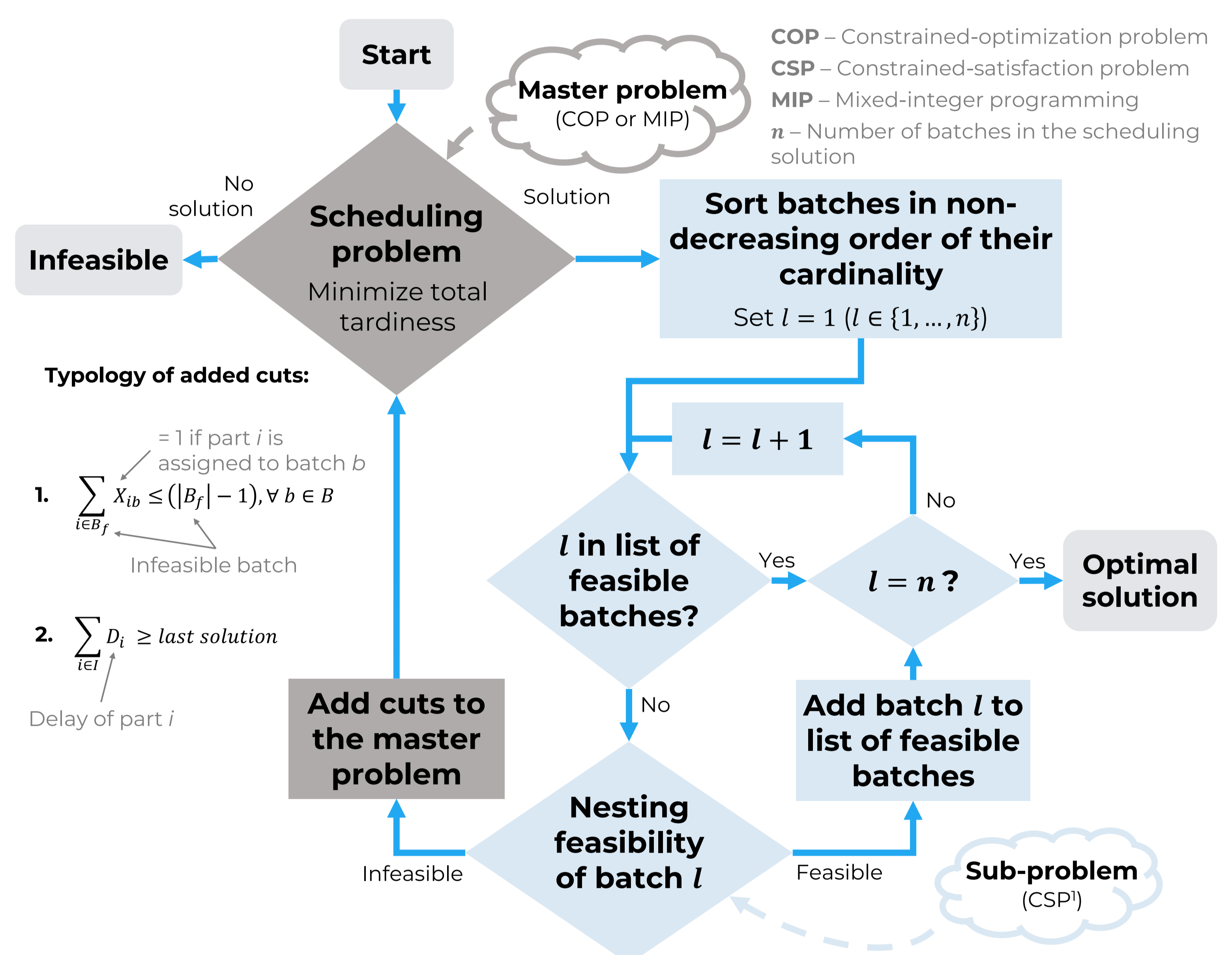
how to solve nesting and scheduling decisions simultaneously?

Nesting is a subproblem for which only feasibility needs to be guaranteed



Logic-based Benders decomposition considering nesting feasibility

Cuts are generated in the scheduling problem when the solution is not feasible from the nesting's perspective



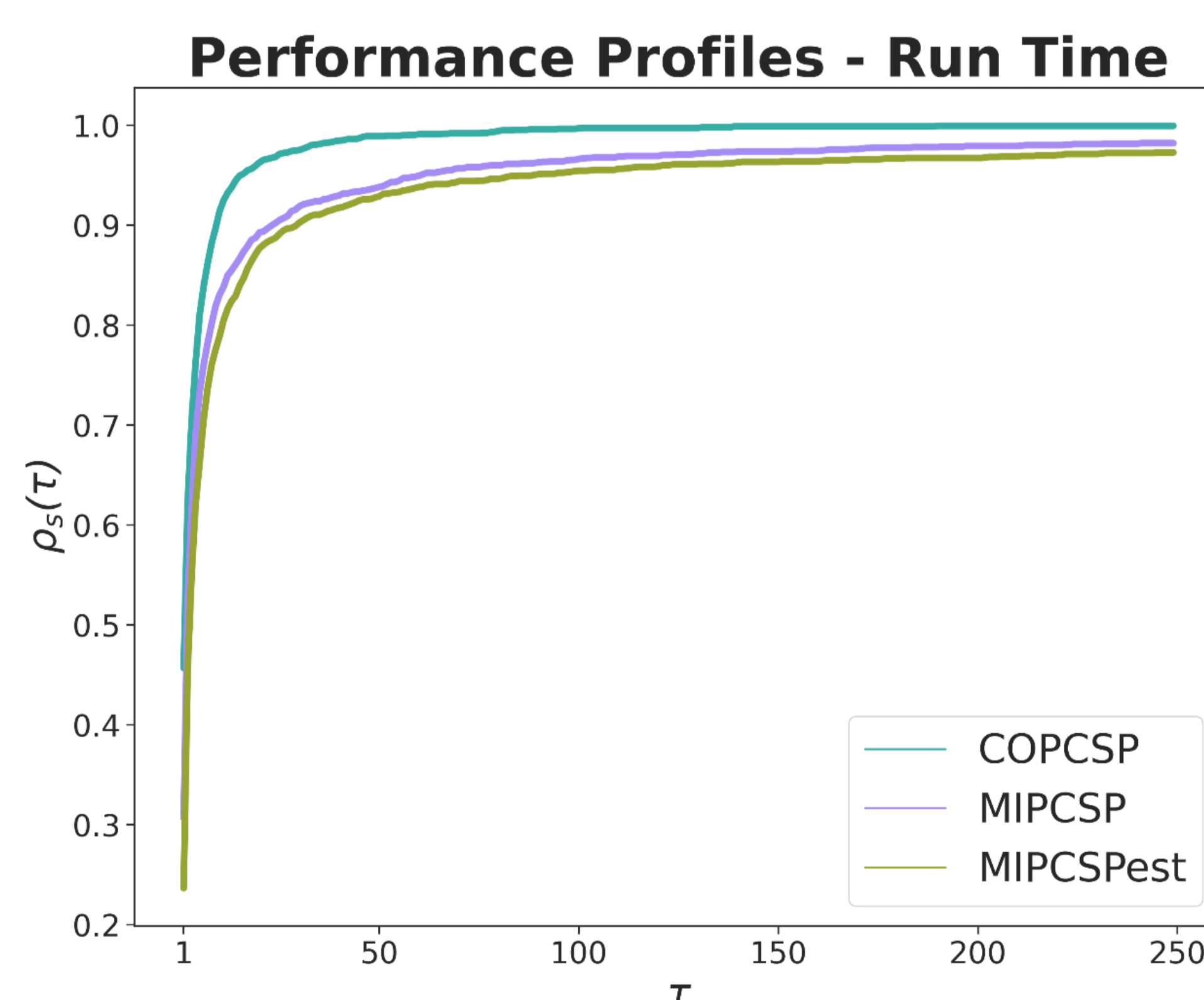
results demonstrate significant improvements

Significantly outperforms the only similar work in the literature ²

Decomposition COPCSP is more robust than MIPCSP

Can solve instances **10x bigger** within time limit of 1 hour

600x faster on instances which both can solve within time limit of 1 hour



future steps

Address the efficiency of the cuts

- Study if the same cuts can be added with more efficient constraints
- Study cuts that go beyond the feasibility check results

Improve solution strategy

- Study ways to reduce the number of iterations to find the optimal solution

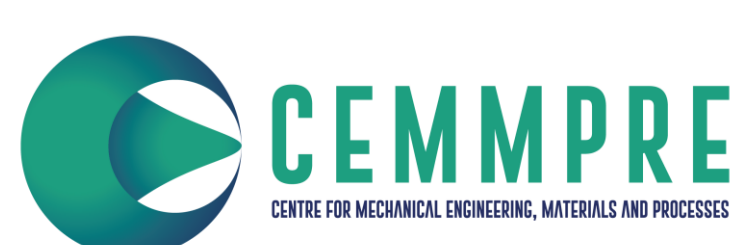
Model add-ons

- Non-identical AM machines and different AM technologies
- Families of products

Study the potential of deep reinforcement learning for this problem

1. Cherri, L. H., Carravilla, M. A., Ribeiro, C., & Toledo, F. M. B. (2019). Optimality in nesting problems: New constraint programming models and a new global constraint for non-overlap. *Operations Research Perspectives*, 6, 100125.
2. Nascimento, P., Silva, C., Mueller, S., & Moniz, S. (2023). Nesting and Scheduling for Additive Manufacturing: An Approach Considering Order Due Dates. In J. P. Almeida, C. S. Galdes, I. C. Lopes, S. Moniz, J. F. Oliveira, & A. A. Pinto (Eds.), *Operational Research. IO 2021. Springer Proceedings in Mathematics & Statistics* (pp. 117–128). Springer, Cham.

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