Tight Bounds for Hybrid Planning

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Introduction

In this paper we study:

- \circledast A hierarchical approach to planning, more specifically:
- ➡ An extension of Hierarchical Task Network (HTN) planning
- $\textcircled{\sc blue}$ Hybrid planning: HTN planning with causal links

Hierarchical Task Network Planning

- \circledast Specifically, we investigate the computational complexity of
- \blacksquare The plan existence problem = Does there exist a solution?
- \square The *plan verification problem* = Does plan *P* solve the problem?

Complexity Results

The complexity of the known classes of hybrid planning problems:

- S Plan existence:
- Primitive: NP-complete
 Primitive & total order: P
 Total order: EXPTIME-complete
 Acyclic: NEXPTIME-complete
 Acyclic & total order: PSPACE-complete
 Regular: PSPACE-complete
 Tail recursive: EXPSPACE-complete

PSPACE-complete

NP-complete

- Tail recursive & total order:
- Se Plan verification:
- \blacksquare Primitive:







 \circledast Source of hardness: The subgraph isomorphism problem

In hybrid planning,

- \circledast there again exist compound and primitive tasks,
- \circledast compound tasks also have preconditions and effects,
- \circledast decomposition methods specify to which subtasks causal links get inherited down

Layer 2 Layer 3 \mathbf{C}_2 Stratification