Hybrid planning for challenging construction problems: An Answer Set Programming approach (Abstract Reprint)

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Abstract

We study construction problems where multiple robots rearrange stacks of prefabricated blocks to build stable structures. These problems are challenging due to ramifications of actions, true concurrency, and requirements of supportedness of blocks by a surface or a robot and stability of the overall structure at all times. We propose a general elaboration tolerant method to solve a wide range of construction problems, based on the knowledge representation and reasoning paradigm of Answer Set Programming. This method not only (i) determines a stable final configuration of the structure, but also (ii) computes the order of manipulation tasks for multiple autonomous robots to build the structure from an initial configuration, (iii) while simultaneously ensuring the requirements of supportedness and stability at all times. We prove the soundness and completeness of our method with respect to these properties. We introduce a set of challenging construction benchmark instances, including construction of (uneven) bridges and overhangs, and discuss the usefulness of our framework over these instances. Furthermore, we perform experiments to investigate the computational performance of our hybrid method, and demonstrate the applicability of our method using a bimanual Baxter robot.

References

[Ahmad *et al.*, 2023] Faseeh Ahmad, Volkan Patoglu, and Esra Erdem. Hybrid planning for challenging construction problems: An answer set programming approach. *Artificial Intelligence*, 319:103902, 2023.