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Temporal Logic (TL)-Based Autonomy for
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abstract Smart-Manufacturing systems are increasingly being used to perform complex tasks on the factory floor. Most often, these systems have hard-coded cases to achieve a specific set of actions -or to assure the safety of the operations. The hard-coding makes the use complicated to re-deploy a system for different tasks. Therefore, it is necessary to have a flexible framework, which can generate a plan based on an intuitive description with system constraints, while satisfying all safety conditions. In this work, we propose Linear Temporal Logic (LTL)-based autonomy framework for smart-manufacturing systems. Specifically, we describe a general technique for formulating problems using LTL specifications. The use of LTL enables us to specify a manufacturing scenario (e.g. assembly), along with system constraints, as well as assured autonomy. Based on the given LTL formulation, a safe solution satisfying all constraints can be generated using a satisfiability solver. To eliminate the exhaustive and exponential nature of the solver, we reduced the exploration space with a divide and conquer approach in a receding horizon, which brings dramatic improvements in time and enables our solution for real-world applications. Our experimental evaluations indicated that our solution scales linearly as the problem complexity increases. We showcased the feasibility of our approach by integrating TL-based autonomy with the simulations of Gantry robot in Siemens NX Mechatronics Concept Designer and TIA Portal (PLCSIM Advanced) for Siemens S7-1500 TCPU connected to Sinamics drives.