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ALGORITHMS FOR DEADLOCK AVOIDANCE AND REVERSIBILITY ENFORCEMENT IN DISCRETE EVENT SYSTEMS

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Abstract. Discrete event systems which are modeled by automata are considered in this work. The algorithms which determine the set of deadlock states and the reversible set, and design the deadlock avoidance controller and the reversibility enforcement controller are introduced for these systems. Moreover, a program is developed to implement these algorithms.
Keywords. Discrete event systems, automata, supervisory controller, reversibility, deadlock.
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1 Introduction

Recently, many man-made systems have been described by discrete event systems (DESs). *Automata* and *Petri nets* [1, 2] are the most common modeling approaches for these systems (e.g., [3]-[14]).

Deadlock and reversibility in DESs, which are modeled by automata and Petri nets, have been popular research areas (for example, [3, 8, 10, 13, 14]). The controller approaches which avoid deadlock and enforce boundedness, reversibility, and liveness in Petri nets were introduced in [12, 15, 16, 13]. Moreover, a program was developed to avoid deadlock in Petri nets in [17]. This program can be also simulated the given Petri nets. For automata model, the supervisory controllers which are based on the forbidden state approach were designed in [11, 14]. While the deadlock avoidance approach was introduced by [11], the other approach which reaches to certain desired marked states was introduced by [14]. In this work, we consider to develop the algorithms for these two controller approaches. In addition, the algorithms which determine the set of deadlock states and the reversible set are presented in this work.

The new definition of the relationship between states is introduced in this work by using the overlapping decompositions and expansions. The overlapping decompositions approach was first introduced by [18] for the case

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