

On generating a ladder diagram for an automatic system based on a Petri net based deadlock prevention policy

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The Ladder diagram is the most popular programming language for the programmable logic controller (PLC) that is commonly used in controlling an automatic system. The Ladder diagram programmers usually suffer from the problem of deadlocks in which two or more competing processes waiting for each other to finish, and thus none of them continues. The deadlock problem of a ladder diagram is difficult to be detected and resolved, yet it is easier to conduct the deadlock analysis over the Petri net associated with a ladder diagram. We use the theory of region and the reachability graph to analyze deadlocks. By techniques of Petri net reduction, we could avoid the problem of state explosion for large-scale Petri nets. After resolving the deadlocks, we convert a deadlock-free Petri net back to a Ladder diagram. We illustrate how these procedures work by several real-world examples.

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