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论文与报告

自动制造系统Petri网的公平活性控制策略

李志武,贾建援

西安电子科技大学机电工程学院,西安

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摘要
基于Petri网的不变式理论,针对典型的自动制造系统,提出了Petri模型强制公平性和活性的方法. 首先,基于网论T-不变式的概念,把系统的网模型设计为一个公平网. 此后,利用P-不变式把一个公平网设计为一个活的且公平网. 同时,提出了非冗余严格极小信标的概念, 大大简化了系统的分析与设计. 一般说来,非冗余严格极小信标是系统严格极小信标一个小的子集,尤其对于复杂系统的网模型. 研究结果表明,只要使非冗余的严格极小信标受控,则系统所有的严格极小信标就不会被清空. 文中举例说明了这些控制方法的应用. 研究结果适用于一大类柔性制造系统,具有相当的普遍性. 这种方法对于自动制造系统的调度设计也具有一定意义和价值.

关键词 Petri网 自动制造系统 活性和公平性 非冗余严格极小信标

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A Fairness and Liveness Control Policy of Petri Net Models for Automated Manufacturing Systems

LI Zhi-Wu,JIA Jian-Yuan

School of Electro-Mechanical Engineering,Xidian University,Xi'an

Abstract
Based on invariants of Petri nets, an approach to the enforcement of fairness and liveness is presented for classic automated manufacturing systems. First of all, a fair net is obtained by adding some places that make the net have only one T-invariant. Then, a fair net is enforced to be live through controlling minimal siphons by P-invariants. Importantly, the concept of redundant strict minimal siphons is put forward, which can greatly simplify the synthesis and analysis of Petri net model of the system considered. Generally, the set of non-redundant strict minimal siphons is a much small subset of the set of strict minimal siphons in a Petri net, particularly in large-scale ones. The results show that all strict minimal siphons cannot be emptied if non-redundant strict minimal siphons are controlled. Examples are presented to illustrate these approaches. The results obtained can be applied to a larger class of flexible manufacturing systems and are of significance to Petri nets based scheduling problems for automated manufacturing systems.

Key words Petri net automated manufacturing system liveness and fairness non-redundant SMS

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通讯作者 李志武

作者个人主页 李志武;贾建援