计算机工程与应用 2009 45 (29): 43-48 ISSN: 1002-8331 CN: 11-2127/TP

研究、探讨

变迁特性服从不同分布的SPN最优路径序列寻找

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收稿日期 2008-5-28 修回日期 2008-8-5 网络版发布日期 2009-10-10 接受日期

摘要 现实中的很多问题可以建模为随机Petri网（SPN）的主干路径寻找问题。假设SPN中变迁所代表的单元是可修复的，变迁的可靠度服从威布尔分布，维修度服从对数正态分布，在此基础上提出广义维修时间的概念，并得到了单元稳态可用度、系统稳态可用度计算方法。为了获取该类SPN的主干路径，根据蚁群算法和SPN的特点提出了一种网络元素可以记录少量信息的带变迁可用度的SPNMA网。在SPNMA运行时，大量的托肯在SPNMA中行走并且在行走过程中留下信息素，以变迁的综合成本，稳态可用度和信息素作为调整托肯路径选择的主要依据；引入基于均匀分布信息量均衡算子、基于正态分布的信息素权重因子和随机托肯等新方法对蚁群算法进行改进，蚂蚁优先选择综合成本低的路径，最终在最优主干路径上形成清晰的蚁路。仿真结果表明托肯可以有效地在最优路径上形成清晰的蚁路。

关键词 随机Petri网 蚁群算法 路经序列 可靠性 维修性

分类号 TP391.9

Optimum route sequence search in stochastic petri net based on transition's features obeying different distributions

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Abstract

Many problems in engineering can be modeled as the mainframe route sequence search problem based on a Stochastic Petri Net（SPN）.Supposing that a unit represented by a transition is restorable，reliability and maintenance degree of a transition obeys Weibull distribution and lognormal distribution respectively，and then the concept of generalized maintenance time is put forward，and the steady state availability formulas of a unit and a system are obtained respectively.In order to find the mainframe route sequence，a SPN with Memorability and Availability（SPNMA），whose elements can record a little information，is proposed based on the ant colony optimization algorithm and features of SPN.When SPNMA is running，enough tokens walk and leave pheromone on the complicated SPNMA.Synthetic cost and steady state availability of transitions and pheromone on transitions are the primary base to adjust route choice of tokens.Pheromone weight multiplier of normal distribution，pheromone balance operator of uniform distribution and stochastic tokens are introduced to improve the ant colony optimization algorithm.Ants give priority to select routes with lower synthetic cost.At last a clear ant route can be found on the route with the lowest synthetic cost.The result of simulation shows that the clear ant route is formed along the best route effectively by tokens.

Key words stochastic Petri net ant colony algorithm route sequence reliability maintainability

DOI: 10.3778/j.issn.1002-8331.2009.29.013

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