

系统工程

基于可用度模型的故障预测与健康管理办法

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摘要:

为了将故障预测与健康管理(prognostics and health management, PHM)技术应用到工程实践中, 提出了基于可用度模型的PHM方法。首先通过广义随机Petri网(generalized stochastic Petri nets, GSPN)和连续马尔科夫链(continuous time Markov chain, CTMC)建立基本单元的软硬件可用度模型和健康状态转换图, 通过求解微分方程得到基本单元软硬件的可用度数值。然后综合软硬件之间的故障相关性建立基本单元的完整可用度模型, 并利用事件调度仿真机制得到其可用度的解。最后将基本单元故障模型同通用的可修系统稳态可用度模型对比, 得到“可用度-故障率-维修率”形式的PHM计算模型, 并以此作为工程应用中PHM分析的有效手段。

关键词: 故障预测与健康管理 广义随机Petri网 连续马尔科夫链 可用度

Method of prognostics and health management based on availability model

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Abstract:

To apply prognostics and health management (PHM) technology in realistic engineering, a method of PHM based on availability model is proposed. Firstly, the hardware and software model of the basic unit and its healthy state transition diagram are established by generalized stochastic Petri nets (GSPN) and continuous time Markov chain (CTMC). The availability of the basic unit could be calculated by sloving differential equations. Combining the relationship of the hardware and software faults, the unit availability model is obtained. Based on event scheduling simulation, the result of the basic unit availability is achieved. Finally, a comparison is made between the failure model of the basic uint and the model of repairable system theory, the “availability- failure rate-maintenance rate” calculation model is obtained and is applied for PHM analysis in engineering.

Keywords: prognostics and health management (PHM) generalized stochastic Petri nets (GSPN) continuous time Markov chain (CTMC) availability

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