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可靠性

基于MCS-CA的考虑共因失效的复杂系统可靠性评估

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摘要:

共因失效普遍存在于现实的工程系统中。如果忽略共因失效对系统的影响, 按照传统假设其部件独立的方法进行可靠性分析会得出过于乐观的结论, 并且作出认为系统符合可靠性需求的错误判断。在考虑系统由部件选择性失效传播引起的共因失效的同时, 提出了一种面向复杂系统的基于蒙特卡罗模拟 (Monte Carlo simulation, MCS) 与元胞自动机 (cellular automata, CA) 集成的可靠性评估算法。传统方法只能解决可以转化为串、并联结构的简单系统的可靠性评估问题, 而所提出的算法打破了这种限制, 使得其应用范围更加广泛。

关键词: 复杂系统可靠性 部件选择性失效传播 蒙特卡罗模拟 元胞自动机

Reliability evaluation of complex systems with common cause failures based on MCS-CA

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Abstract:

Common cause failures exist in the real-life engineering systems widely. If the impact of common cause failures on systems is ignored and the systems reliability is analyzed with traditional methods in which each component is independent, it will draw a too optimistic conclusion and make a wrong judgment that systems reliability meets the demand. This paper presents a complex systems oriented method of evaluating the reliability based on the integration of Monte Carlo simulation (MCS) and cellular automata (CA) in consideration of components with propagated failures having selective effect. The traditional methods have the limitation that they can only be used to solve the problems of reliability evaluation of simple systems which can be decomposed into series and parallel structures, but the proposed method is out of the limitation and with broader applications.

Keywords: complex system reliability components with propagated failures having selective effect Monte Carlo simulation cellular automata

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