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含故障统计相依组件的多态复杂系统故障树分析

Fault tree analysis of complex multistate system with fault statistically dependent components

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中文关键词: [重复使用火箭发动机](#) [故障树分析](#) [多态系统](#) [布尔算法](#) [统计相依性](#)

英文关键词: [reusable rocket engine](#) [fault tree analysis](#) [multistate system](#) [Boolean algebra](#) [statistical dependence](#)

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中文摘要:

为精确评估可重复使用火箭发动机系统可靠性, 采用带约束变量的布尔算法将状态分析与故障树分析恰当结合, 从而对含故障统计相依组件的复杂多态可重复使用火箭发动机系统进行可靠性分析. 以航天飞机主发动机(SSME)为研究对象, 对管路多态性及预燃室和涡轮泵之间的故障相依性进行深入研究. 结果表明: 该布尔算法能够很好地消除组件统计相依性从而简化复杂多态系统故障树, 组件之间失效相依性对系统可靠性影响较大, 因此需要加强组件多态及相依性的研究来获得更精确的系统可靠度.

英文摘要:

To exactly estimate the reliability of reusable rocket engine, a Boolean algebra with restriction on variables was introduced to properly combine fault tree analysis with state analysis, and the reliability analysis of complex multistate system with statistically dependent components were performed. Both the multistate of pipes and the statistical dependence between preburner and turbopump of space shuttle main engine (SSME) were deeply studied. The result show that the Boolean algebra can well eliminate statistical dependence among components to simplify the fault tree analysis of complex multistate system, and the statistical dependence has significant influence on the system reliability, so further research is required for higher performance of the reusable rocket engine.

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