Software Reliability Growth Model For N-version Fault Tolerant Software with Common and Independent Faults

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ABSTRACT

Both the industrial and academic worlds have become increasingly concerned in developing highly reliable software for real-time control systems. To achieve the high reliability software with safety-related standards is the main challenge specially in controlling safety-critical systems, such as aircraft controls, railroad signalization systems and nuclear plant controls, where risk ratio is at the highest level because small errors could lead to hazardous accidents. N-version programming (NVP) is one of the primary techniques used in fault-tolerant software to increase reliability of safety critical applications. NVP technique enables the software to be fault-tolerant, helps to produce accurate results even in the presence of faults. In this paper, we propose a nonhomogeneous Poisson process based (NHPP) software reliability growth model (SRGM) for NVP systems by incorporating the features of both independent and common faults, whereas fault detection rate is supposed to be logistically distributed. A straightforward analytical technique is used for evaluating the reliability of software systems developed using NVP. We offer closed structure analytical expressions for the system reliability and other performance metrics. Furthermore, using appropriate parameters as special instances, the numerical assessment for two illustrative examples 2VP and 3VP is carried out. The numerical simulation is performed with the aid of MATLAB. The analytical results are exhibited and compared by neuro-fuzzy results based on fuzzy interference system.

Keywords*:* N-version programming; Software reliability; Neuro-fuzzy technique; Software reliability growth model; Fault tolerance.

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