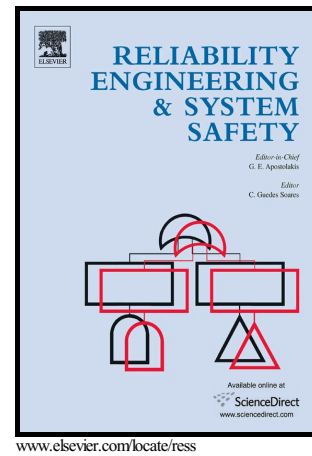


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Time-dependent Reliability of Wireless Networks with Dependent Failures

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Abstract

Because the Internet of Things is embedded in the physical system, the network failure leads to the loss of money or life. The dependent failure or the common cause failure completely destroys the redundancy for improving the reliability, so it severely impacts on the system reliability. Incorporating the common cause failure, we analyze the exact time-dependent all-terminal reliability of the wireless networks with dependent failures, which provides a more realistic assessment of the reliability. We consider both hardware failure and channel fading in the static environment. First, by incorporating the common cause failures into the time-dependent reliability polynomials, we derive the exact time-dependent reliability polynomials of the regular wireless networks of which each node connects other nodes via four point-to-point radio modules. Second, we derive the polynomials of the wireless networks including the random mesh network where each node connects other nodes through the redundant radio-broadcast modules. Finally, we calculate the exact instantaneous failure rates. Surprisingly, we have found that the torus network comprised of the node holding four redundant radio-broadcast modules is compatible with the complete network that is known as the most reliable network.

Keywords: Network reliability, Dependent failure, Common cause failure, All-terminal reliability, Wireless networks, Tutte polynomial, Internet of Things

Notation

BroadcastRadio- i The wireless network where the number of the radio-broadcast modules of each node is i .

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