A connection probability model for communications networks under regional failures

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A B S T R A C T

Communications networks are often disrupted by human-initiated and natural disasters such as terrorist bombings, aerial bombardment, earthquakes, floods and volcanic erup- tions. Estimating the connection probability of a communications network under a regional failure caused by such an event is essential to evaluating network performance. This paper proposes a probabilistic model called the Connection Probability of a Communications Net- work under Regional Failures. The proposed model estimates the connection probability of each link that connects a pair of nodes under a failure scenario; these probabilities are then used to compute the generalized connection probability metrics for the network of interest. The model is continuous over its failure region, which is considered to be circular with a certain radius. The maximum failure impact occurs at the epicenter and the impact grad- ually drops to zero beyond the failure circle. The model helps identify the failed network links and their degrees of failure. A case study involving the U.S. backbone communications network with various failure epicenters and radii demonstrates the applicability and utility of the proposed model.

Keywords: Communications Networks Failures; Connection-Probability Analysis Modeling and Simulation