

# Preface

The robustness of a communication network under attacks is of prominent importance to both civilian service providers and military system operators. In this monograph, we start with literature overview of the network reliability study for networks under various attacks and then focus on the robustness of networks under large-scale physical attacks. In particular, we study the area-attack case, where each attack kills all the nodes and links that are touched by the attack area. Such a scenario can be a result of attacks from large-scale power outages or weapons of massive destruction, and, in general, it belongs to the category of networks under correlated attacks. Specifically, for the network under consideration, we assume that the nodes are deployed over a unit area according to a Poisson point process, and consider both the traditional random network model where each node pair is connected with a certain probability and the range-limited random network model where a node pair is connected with a certain probability only if the two nodes are within a certain range. The attack area is modeled as a small dish with radius  $r$  and randomly located within the unit area. Based on such network and attack models, we first study the link-level network robustness by investigating the link loss probability and the expected number of lost links. We then study the network-wide robustness under an area attack, where we first present four desired properties for a well-defined robustness measure and accordingly propose a new measure: the percentage of the surviving end-to-end communication pairs. Simulation results on a real-world network are given to verify our analytical results.

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