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研究简报

基于流量攻击和边失效的复杂网络脆弱特性

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摘要
基于流量的攻击可能对复杂网络造成严重破坏，现有研究主要针对节点攻击。该文分析了部分边失效时，复杂网络的脆弱特性。此外，分析了时机策略和网络规模对边失效的影响。通过研究节点负载和度分布特点，发现复杂网络的脆弱特性源于其幂率度分布引起的节点负载的极度非均匀分布。仿真实验表明，复杂网络对随机的边失效具有较强的耐受力，但在一定条件下，攻击极少量重要边就可能引发连锁的节点过载失效，而导致网络溃散。

关键词 复杂网络 边失效 负载 度分布

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Frangibility of Complex Networks Based on Flow Attack and Edge Failure

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Abstract
Attacks based on flow may bring tremendous damage to complex networks. In existing works, the cases of nodes attacking are mainly concerned, however, few work is involved to the edges. In this paper, the frangibility of complex networks is discussed in the case of some edges being deleted. Additionally, the effects of time strategy and network size are also discussed. By analyzing the load and degree of complex networks, it is demonstrated that the complex networks possess a high heterogeneous distribution of loads, which is caused by the power-law degree distribution, and the heterogeneity makes the networks particularly vulnerability to attacks. The analytic results show that complex networks exhibit strong error tolerance to random failures of edges, but a large-scale cascade of node failure can be triggered by disabling several key edges, which may result in the collapse of networks.

Key words Complex network Edge failure Load Degree distribution

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