

Link optimization for fiber communication network with sensing capability(P2.3)

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Abstract

- ◆ This paper proposes a link failure monitoring method, which is easy to obtain link state information and to optimize link thereafter. In the fiber communication network model, the parameters of network topology and sensing capability are introduced into the fuzzy logic system and numerical study are carried out.
- ◆ The study explores the influence of Poisson parameter, number of links, number of nodes and sensing capability factors on the probability of link failure in fiber communication network.

Operation method

- ◆ Fuzzy logic system is a computational framework based on fuzzy set theory, fuzzy rules and fuzzy reasoning [1]. The membership of fuzzy set is obtained from specific input. The fuzzy conclusion is obtained from the membership of fuzzy rules and input to related fuzzy sets. The fuzzy conclusion is transformed into concrete output.
- ◆ 20 nodes are randomly generated on a 100*80 plane. The node is connected to the two nearest nodes. As shown in Figure 1, the black number i represents the i th node, and the red number j represents the i th link.
- ◆ The fuzzy logic system outputs the link failure probability. The fuzzy rule is composed of link sensing capability, betweenness, number of data packets and distance. There are three levels of sensing capability, betweenness and data packets: low, moderate and high, and three levels of distance: far, moderate and near. Since there are four arguments each of which has three possibilities, 81 rules need to be set.

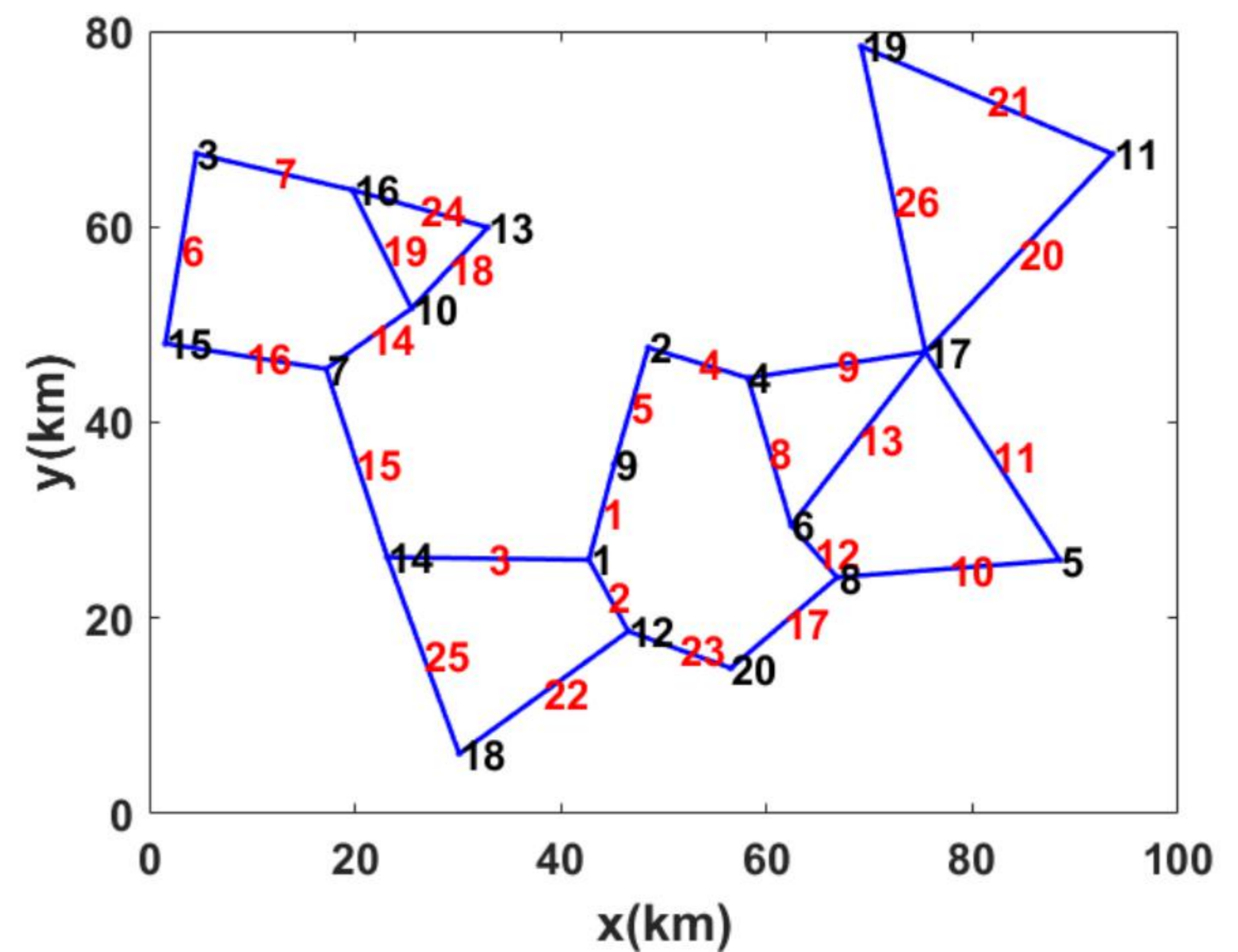


Fig. 1. Communication model.

Results and Analysis

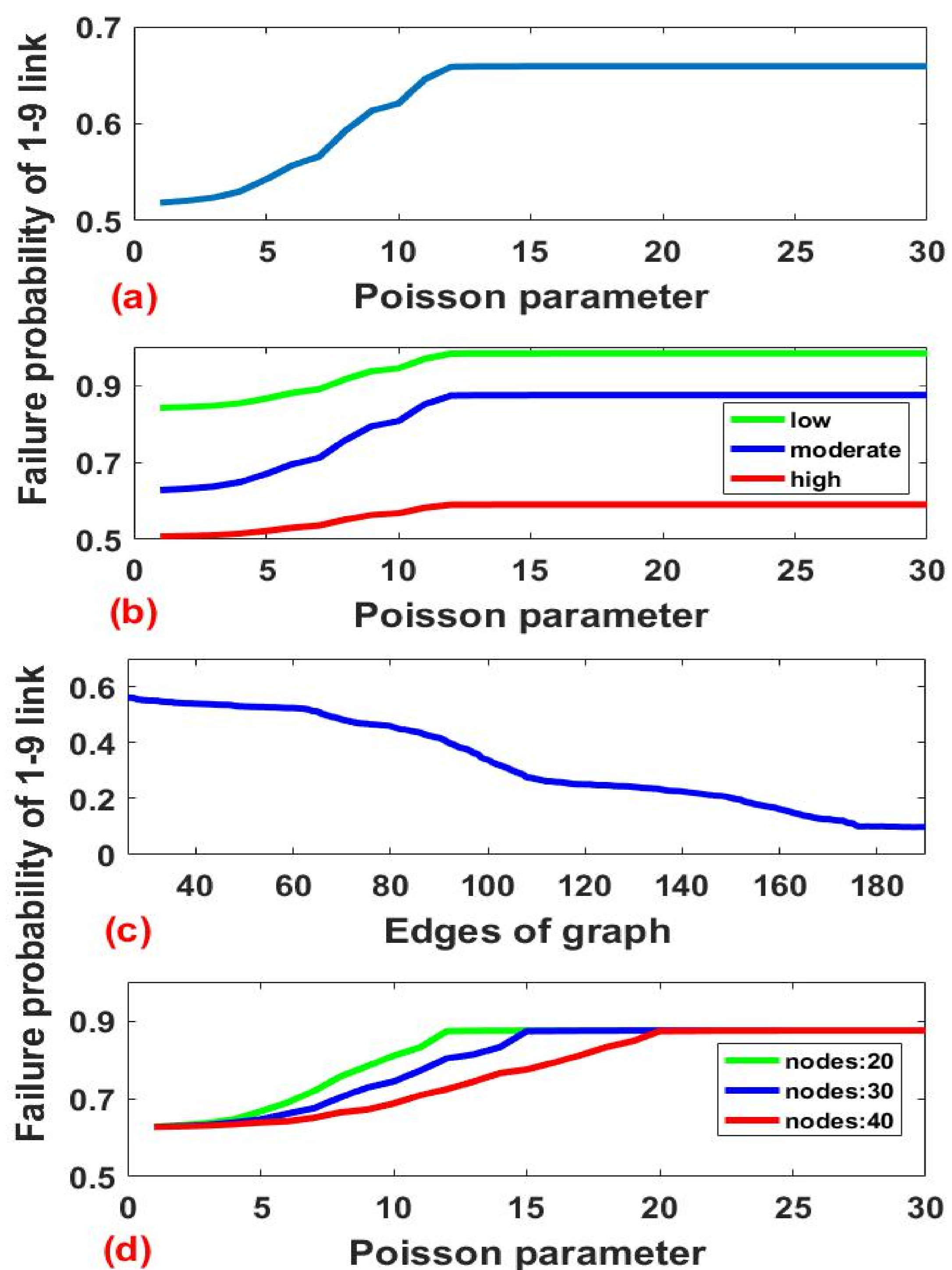


Fig. 2. Influence curve of different independent variables on link failure probability

- ◆ Figure 2. (a) is the influence of λ change on the failure probability of 1-9 link, and (b) is the analysis of changing the sensing capability based on (a). (c) is the influence of changes in the number of network topology links on the failure probability of 1-9 link. (d) changes network topology nodes for analysis on the basis of (a) and (b).

TABLE 1. CURVE ANALYSIS OF DIFFERENT PARAMETERS.

| Table Head | Table Column Head | |
|------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Change of independent variable | Curve analysis |
| (a) | λ increased from 1 to 30 | The probability of link failure increases with the increase of λ and tends to be stable. |
| (b) | When the link sensing capability is set to low, moderate, or high, the λ increases from 1 to 30 | When the sensing capability is low, the failure probability of links 1-9 is up to more than 90%. As sensing capabilities increase, the probability of failure decreases. |
| (c) | The number of links increased from 26 to 190 | As the number of edges increases, the probability of failure decreases. |
| (d) | Add a new node and the λ increases from 1 to 30 | As the number of nodes increases, the failure probability decreases. |

Conclusions

- ◆ This paper simulates the topology of fiber communication network and innovatively introduces the link sensing capability to judge the link failure in fuzzy logic system. Synthetically analyzing the experimental data, it is found that the change of sensing capability has a greater influence on the probability of link failure than the change of network topology and λ .
- ◆ The experimental results show that the improved fuzzy logic system can enhance the judgment of the link failure efficiency and has strong adaptability and robustness. The link failure states obtained by the method in this paper are of guiding significance for the link optimization of fiber communication networks.