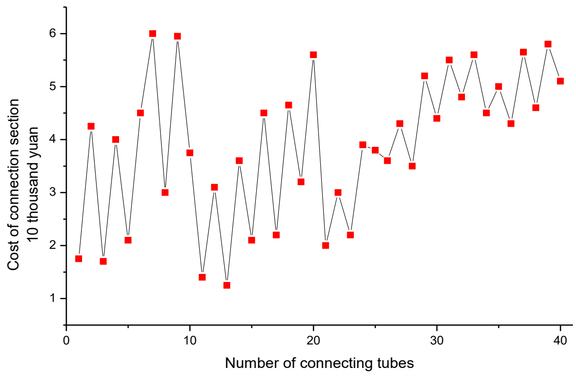


**Figure 8.** Cost of the connections between the two networks

It can be seen from the above figures that the two networks were more reliable under external pressure than without external pressure. This is attributable to the following facts: without external pressure, some nodes have no flow after connection due to the pressure limit; with external pressure, the flow between the nodes is not limited by pressure; the connecting pipe elements with high reliability tend to have high cost. Considering both reliability and cost, it is recommended to select the connecting pipe elements with high reliability and low cost. Through comparison between reliabilities and costs, it is learned that pipe element 13# had the lowest cost while pipe element 1# boasted the highest reliability. In general, the two pipe elements enjoyed high reliability at a low cost. Thus, the optimal connection mode is: connecting nodes 2# and 5# of the primary network to nodes 2# and 4# of the secondary network, respectively; connecting nodes 2# and 5# of the primary network to nodes 4# and 2# of the secondary network, respectively.

## 5. CONCLUSIONS

This paper establishes fluid pipe network models based on topological analysis. The established models were proved to have high computing accuracy, considering the pressure loss and the elevation difference of nodes on the two sides of each pipe. On this basis, the author identified the optimal connection between two fluid pipe networks that back up each other, through importance evaluation, reliability calculation and cost computation. Then, the proposed connection optimization strategy was verified through a simulation application in a tree-shaped water injection system. The simulation results show that our method is rational and feasible in that it simultaneously ensures the operation efficiency and reduces the cost of the fluid pipe networks. The research findings provide a good reference to the design and optimization of fluid pipe networks.

## ACKNOWLEDGMENTS


Key Scientific and Technological Research Projects in Henan Province (no: 162102110130); study on Identification of solute transport parameters in unsaturated soils.


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