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Development of new computational methods for identifying segments and estimating the risk of water supply interruption for a segment in water pipe networks

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ABSTRACT

In this paper, new algorithms for identifying segments and unintended isolations for water pipe networks were developed. The developed algorithms are based on the two topological relation data that are the connectivity relationships between the nodes and pipes and the location information of valves along pipes. The algorithms for identifying unintended isolation specifically utilized the connectivity relationships between the segments. The developed algorithms employ more efficient processes of finding pipes and nodes that are isolated by valve closure than the previous matrix-based algorithms. Moreover, the size of the matrices has been greatly reduced compared with the previous studies for more efficient calculations. The developed algorithms were implemented as computer programs using the Matlab software and applied to identify the segments and unintended isolation of a case study water pipe network. A new water supply risk estimation method that uses the deterioration scores of pipes, nodal demands, water rate, and average repair time was also presented. The risk estimation method was used to sort and prioritize the segments of the case study system for a further maintenance investment decision.

Keywords: Computational algorithms; Risk; Segment; Unintended isolation; Water pipe network

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