181.Optimal Design of Harmonic Monitoring System in Distribution Network Based on Ant Colony Algorithm

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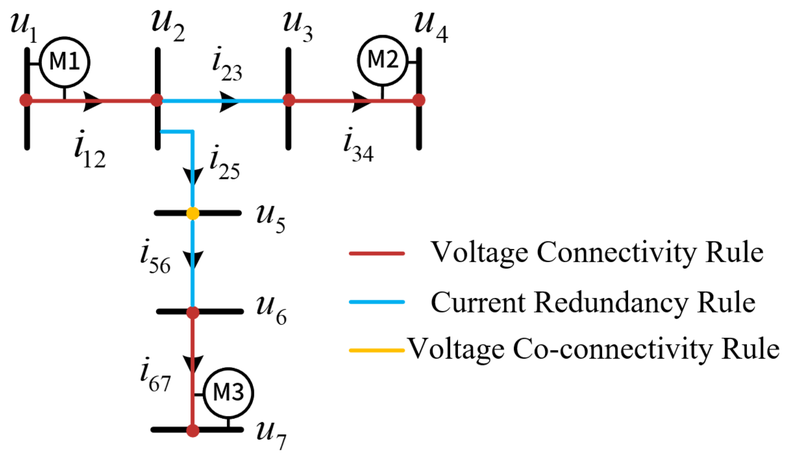
Introduction

This paper proposes an optimal design methodology of harmonic monitoring system based on connectivity model and modified ant colony algorithm, which aims at reducing the cost of harmonic monitoring while estimating all state variables of distribution networks. Moreover, real values of the system are obtained from Simulink/MATLAB for comparison, which demonstrates the effectiveness of the proposed method.

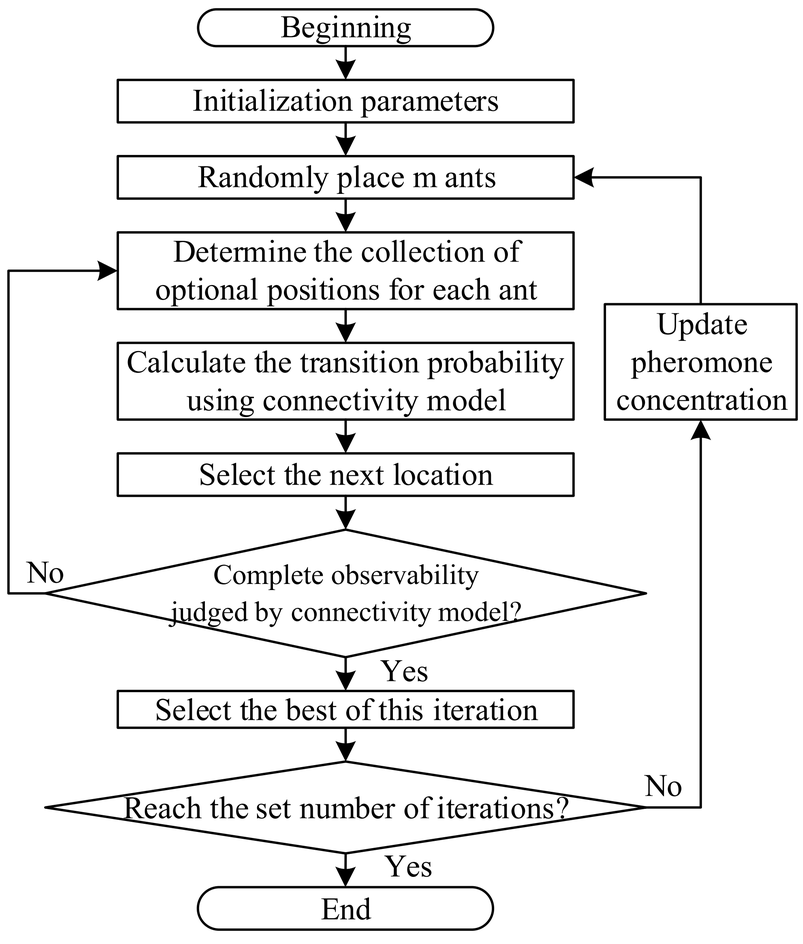
Connectivity Model

The connectivity model is to make an observability judgment and state variables estimation by topology connectivity.



Modified Ant Colony Algorithm

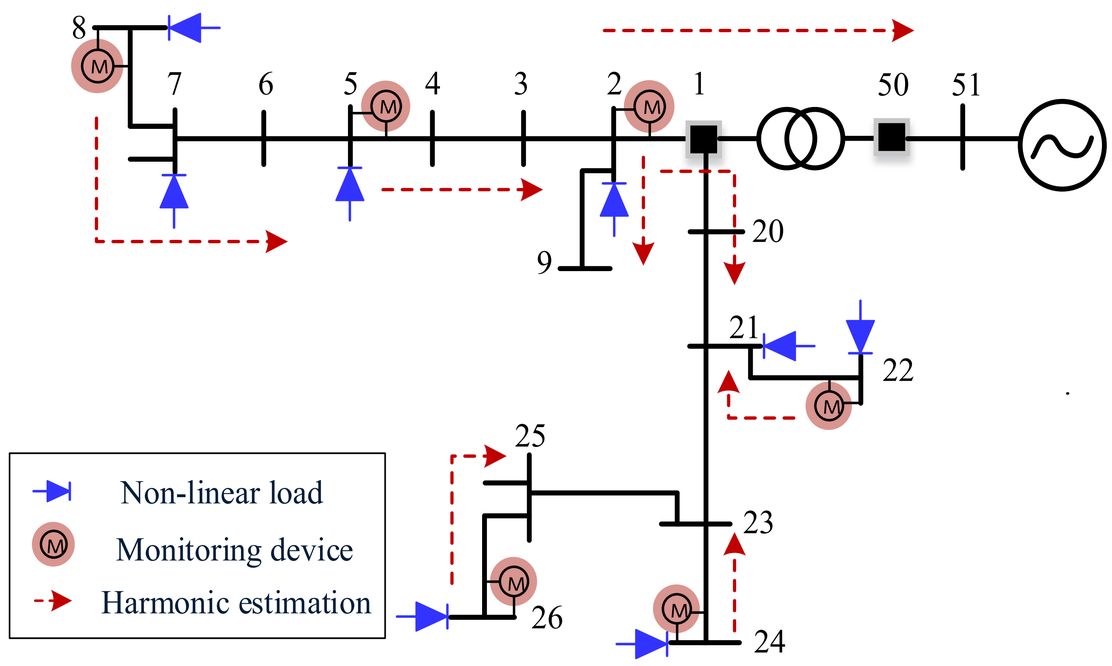
Due to the similarity of key variables and optimization purpose, we choose ant colony algorithm as optimization method. And there are some modifications of key steps in this paper.



The calculation of transition probability, update of pheromone and establishment of taboo list are related to connectivity model.

Results

Simulation is carried out on the IEEE-18 bus network with 8 non-linear loads. The optimal result is that at least 6 monitoring devices are required to guarantee the fully network observability and estimation of harmonics.



And real values of the network are obtained from Simulink/MATLAB for comparison. Compared with real values, the highest error of estimated values is lower than 1.0%, which proves the method effective for distribution network harmonic monitoring.

Conclusions

A method for optimal harmonic monitoring system design is shown in this paper based on ant colony algorithm, which uses connectivity model for system observability and harmonic estimation. The simulation and results indicate fewer monitoring devices are required for fully observability and harmonic estimation. This method is proved to be effective through the comparison between estimated values and real values.