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# Analytical Solution to Temperature Distribution in Frozen Soil Wall with Wavy Boundaries by Single-Row- And Double-Row-Piped Freezing

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## Abstract

The existing formulae to calculate the temperature field distribution of single-row or double-row piped freezing are based on the assumption that the boundaries of the frozen soil wall have already developed to straight lines. In this paper, analytical solution to steady-state temperature field of single-row and double-row piped freezing with wavy boundaries are deduced by thermal potential superposition method. The comparisons of the calculating results of the new analytical solutions with the numerical simulation of steady-state problem and the Bakholdin's solutions show that the analytical solutions are correct under steady-state assumption. Also, the comparison results show that the new solutions are more accurate than the Bakholdin's solutions, especially when the thickness of the frozen soil wall is thin in the early stages of freezing process.

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