

垂直埋設式 U 型管淺層土壤溫能熱交換器之熱傳增強研究

Investigation of Thermal Performance Enhancement on Soil Heat Storage using Borehole Heat Exchangers

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摘 要

使用垂直式 U 型管土壤熱交換器作為空調系統冷卻或取熱目的之技術在已開發國家盛行已久，如何在鑽井的設計上改良突破使得昂貴的初始架設能夠得到最大之效果，乃為一重要課題。本研究主要針對垂直式 U 型管土壤熱交換器系統的性能以及設計策略進行分析研究，藉由建立由橫截面熱阻為主要構想之穩態數學理論模式以及使用電腦軟體 Fluent 進行分析，配合國外的實驗論文詳細資料進行正確性的驗證之後，以此為基準對影響最大的設計參數如最佳鑽井深度、回填土熱傳導性質、工作流體質量流率等進行最佳化分析。

關鍵詞：土壤熱交換器、U 型管、最佳化、Fluent。

Abstract

The use of vertical U-shaped borehole heat exchangers for air-conditioning purposes has been widely practiced in the developed nations for a long time. The objective of maximizing system performance by an optimized design for borehole heat exchangers is of significant importance for its hardly changeable after initial installation. Current thesis conducts thorough analysis and investigates several design strategies on borehole heat exchangers. First, setting up computer programs for steady mathematical analytic model analyzes for borehole heat exchangers. After verifying the accuracy of the mathematical model by comparing with foreign experimental studies, the experimental settings is then to be used as a baseline for optimization on dominant design parameters such as optimal borehole depth, grout thermal conductivity and mass flow rate of working fluid.

Key words: Borehole Heat Exchangers, U-shaped tube, Optimization, Fluent.

一、前 言

在能源的使用中，建築物所消耗的能源也隨著人們對於生活水準要求的提高而大大地增加。

98 年 11 月 3 日收件 98 年 11 月 27 日受理

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