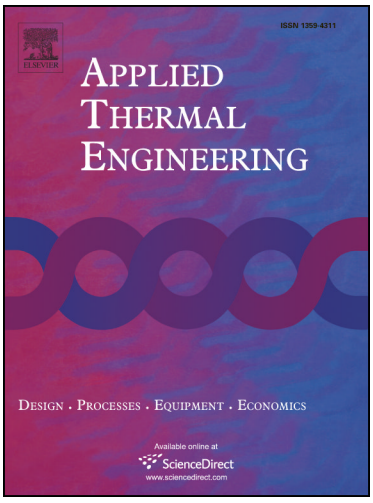

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Energy consumption prediction for water-source heat pump system using pattern recognition-based algorithms

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Key words

Water source heat pumps; Energy consumption prediction; Clustering analysis; Operation tree; Operation patterns of pumps

1. Introduction

The building sector are responsible for approximately 40% of the global energy consumption and 33% of the Green House Gas emissions [1, 2]. As for the important part in building services systems, the heating, ventilating, and air-conditioning (HVAC) system has drawn growing attentions and accounts for nearly half of the energy consumed of buildings [3,4,5]. Therefore, HVAC systems has become the focus of research in building energy conservation field.

Prediction of building heating consumption is beneficial to many building energy management tasks, such as optimal operation strategies or controls [6, 7], demand and supply management [8], and energy diagnosis [9]. However, the prediction task is a non-linear process which can be easily influenced by a variety of factors, such as outdoor weather conditions, occupiers' behaviors, building envelopes, etc. As a consequence, the data-driven methods are attached with much attentions due to their flexibility and efficiency compared to the physical-model [10].

Various researchers have put their efforts on developing the forecast and simulate models for building energy consumption. Some of the important researches are summarized. Zhao [11] classified these prediction methods into three categories, namely, engineering, statistical and artificial intelligence (AI) methods. Owing to the ease of use and adaptability to seek optimal solutions in a rapid manner, the AI-based approach has gained popularity in recent years [11].

Fan [12] presented a data mining (DM) based approach to developing ensemble models which consists of eight models for predicting next-day energy consumption and peak demand. The approach was applied to the International Commerce Center (ICC) in Hong Kong. The results showed that the ensemble models can achieve better