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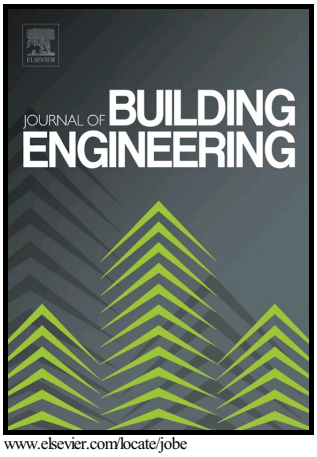

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Abstract

Saving energy in rural residences is of great importance. In this paper, a field investigation of the basic physics information and thermal environment of rural residences was carried out, using a rural residence in Dalian as an example. Based on the analysis of this investigation, we find that the thermal performance of the building envelope, the living habits of the occupiers and the household economy have a close relationship with unsatisfactory residential thermal environment. Therefore a new perspective regarding optimization of rural residences is provided in terms of building plan layout, shape and properties of the building envelope. This paper presents rural residential optimization methods in which orthogonal numerical test and rules for integrated balancing methods are combined. Through numerical simulation with TRNSYS, the significance of different factors influencing indoor temperature has been given, and the optimal thermal parameters of the building envelope and plan layout of a rural residence are determined. The results show that south window-to-wall ratio is the most significant factor influencing indoor temperature and therefor this is the primary parameter requiring optimization. The south window-to-wall ratio of a rural residence in a cold region should be 45%. In addition, it is demonstrated that the optimal rural residence, when compared to traditional rural residences, has a satisfactory social benefit in terms of improving the indoor thermal environment and protecting the atmospheric environment during a heating season. This paper will offer a theoretical reference for the construction of modern rural residences.

Keywords: Rural residence; Indoor thermal environment; Design parameters optimization; Orthogonal numerical experiment

1. Introduction

Energy shortage has been paid increasing attention in recent years due to the fact that energy is becoming a restricting factor with respect to social advancement. In light of the current unsatisfactory situation, some policies have been published in regions and countries all over the world. Examples of these policies are the