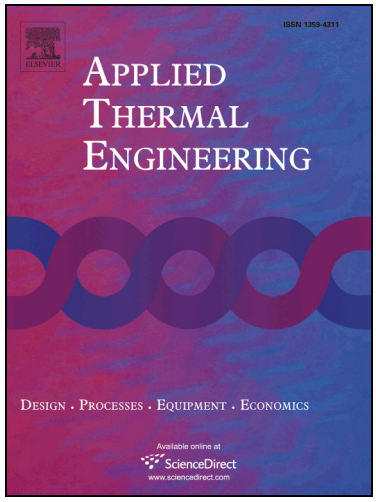

Research Paper

Numerical and experimental investigation on a concrete slab thermal conductivity increase due to metal cylinders perpendicular to the slab surface insertion

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Numerical and experimental investigation on a concrete slab thermal conductivity increase due to metal cylinders perpendicular to the slab surface insertion

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Abstract

The radiant floor heating systems offer some peculiar advantages, but their growing favour is mostly due to the possibility of employing low temperature energy sources; obviously, the higher the thermal conductance of the mortar where are embedded the pipes in which hot water flows, or of the covering layer of the pipes, the more this feature can be improved. In this study thermal conductivity increase of mortar or concrete plates due to embedded cylinder metal elements perpendicular to the slab surface is evaluated, through a numerical investigation. Correlations with a general effectiveness have been found, and validated through an experimental investigation. Results show that, in the investigated conditions, thermal conductivity can be increased up to about five times, depending on the kind of metal, the cylinder diameter and length, the number of cylinders per surface unit, the concrete covering of the cylinders.

Keywords

Radiant floor heating systems; thermal conductivity increase; concrete slab; metal bars;

1. Introduction

The radiant floor heating systems offer some peculiar advantages, as a good flexibility in modifying the internal partitions of the indoor space; the absence of terminal heaters in the heated environment, such as fan-coils, that could cause particulate movement and reduce air quality, usually required in some important environments, e.g. hospitals; the provision, also in high roof spaces (e.g. churches, gymnasia, etc.), of a good thermal comfort, otherwise difficult to obtain.

However, their growing favour is mostly due to the possibility of employing low temperature energy sources, such as solar energy, heat pump, waste heat recovery [1][2][3].

The higher the thermal conductance of the mortar where are embedded the pipes in which hot water flows, or of the covering layer of the pipes, the more this feature can be improved.

Some studies have been conducted in this way. These studies mainly concern various types of aggregates and additives effects in cement concrete; covering materials nature and laying