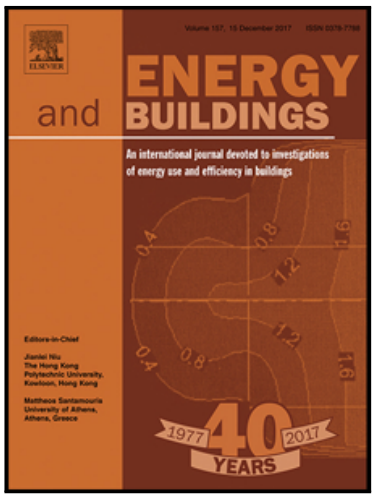

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Evaluating highly insulated walls to withstand biodeterioration: A probabilistic-based methodology

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Abstract

The performance to withstand biodeterioration of highly insulated walls is evaluated by applying a probabilistic-based methodology that accounts for the involved uncertainties and investigates their significance. Three approaches to representing the outdoor climate are investigated by varying the method and time duration. The temperature-dependent thermal conductivity of the insulation material is measured, and subsequently, a stochastic model is proposed to represent this property. Deficiencies, considering penetration of wind-driven rain, are accounted for and represented by moisture sources in a parametric way. A sensitivity analysis is performed to identify the influential parameters, and subsequently, simplify the system representation by reducing the number of input variables in order to reduce the computational efforts. The timber ventilated walls show satisfactory performance to withstand biodeterioration unless potential deficiencies are considered. The study demonstrates that the probabilistic-based methodology enables a more systematic approach to evaluate wall constructions. It accounts for the involved uncertainties, provides a clear association of the microbial growth to its likelihood, and enables the identification and significance of the dominant parameters; hence, it delivers a more comprehensive conclusion regarding the performance of constructions.

Keywords: uncertainty; sensitivity analysis; highly insulated walls; mould; decay; thermal conductivity.

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