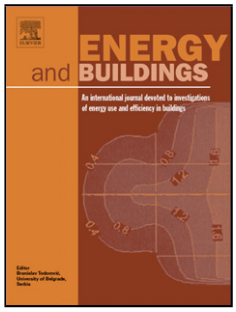

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Box window double skin façade. Steady state heat transfer model proposal for energetic audits

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Abstract: - This study presents a simple heat transfer methodology for box double skin façade. There are a number of numerical methods described in different papers, but at local and European level it is a lack of standards or unique methodologies regarding this system. The methodology presented is an extended and corrected version of a heat transfer method through a double-glazed window described by P. H. Oosthuizen and David Naylor in [1]. The box double skin façade consist of an internal double pane window and a 10 mm secure glass as double skin. The methodology incorporates heat transfer by conduction and convection, considering two extreme climatic conditions for exterior temperature. The main purpose of this study is to identify the difference between single-skin façade and double skin façade from heat transfer point of view. For this purpose were taken into account and calculated face temperatures, total thermal resistances, transmittances and heat fluxes. Analyze of the heat transfer indicators were described by tabular values and by one year chart for Brasov region, in Romania. For a faster calculation some second degree polynomial equations are proposed, for finding thermal conductivity, thermal diffusivity and kinematic viscosity as a temperature function. For each property it was found one equation for air and one for argon. Argon and air are the most common gases included in window systems. Overall, the study shows an increase in envelope insulation with greatest benefits during the cold season.

Key-Words: - glazed double skin façade, box window, office building, energy, heat transfer, energetic audits

1 Literature review

Energy audits for buildings are an essential tool to achieve energy savings. They are necessary to assess the existing energy consumption, identify the range of opportunities to save energy and propose solutions. For this purpose energy auditors need a simple calculation method in order to be able to propose double skin façade as a good solution, taking into account all important factors.

Many people contribute to general framework of developing a numerical heat transfer model for double skin façade but much of the literature deals mostly with specific topics in heat transfer modeling.

Most of the numerical solutions for heat transfer in double skin façade have been developed after 2000. Saelens D. (2002), in his Ph.D. is presenting a two-dimensional development of a numerical model for multiple-skin façades for mechanical and natural ventilation, based on a cell centered control volume method (CVM). In his conclusions it states that obtaining a reliable expression for the heat transfer coefficient is difficult, due to system complexity, and numerical results depend on the accuracy of the input parameters, on the value of the convective heat transfer coefficient and on the numerical error. During night time and during situations with low solar radiation, uniform wall temperature expressions were used in his study, because measurements show small vertical temperature gradients and temperature profiles coincide very well with the measurements [2].

A two-dimensional steady state numerical study has been carried out by J. Xamán et al. (2004) to examine the fluid flow and heat transfer by natural convection in a tall cavity