CONDUCTIVE HEAT TRANSFER FOR OPAQUE ROOFING MATERIAL AT DIFFERENT PITCH ANGLE IN MALAYSIA

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ABSTRACT

CONDUCTIVE HEAT TRANSFER FOR OPAQUE ROOFING MATERIAL AT DIFFERENT PITCH ANGLE IN MALAYSIA

Conductive heat transfer is one of the modes of the transfer of heat through material. This refers to heat gains and losses into and from the building. This is an empirical study on conductive heat transfer for opaque roofing material at different pitch angle in Malaysia. The aims of this study are to measure surface temperature of opaque roof for different pitch angle, to calculate conductive heat transfer of opaque roof at different pitch angle and also to evaluate relation between conductive heat transfer of opaque roof at different pitch angle. Data were obtained via field experiment done in the campus of UiTM in Shah Alam. In the experiment, two types of opaque roofing material were used which is galvanized iron and asbestos. The sample material were assembled at three pitch angle of 0^{o}, 25^{o} and 45^{o}.Data were simultaneously collected for the three pitch angles for material 1 and it was then repeated for material 2. Temperatures of the upper and lower surfaces of the sample materials were measured using thermocouple type T and logged on data logger DT80. Data were recorded at an internal of 10min for duration of three days. Conductive heat flux was calculated use Fourier's Law. The conductive heat flux for galvanized iron is 938.82kWm^2, 900.62kWm^2 and 612.32kWm^2 for pitch angle 0^{o}, 25^{o} and 45^{o} respectively that for asbestos 4648.01Wm^2, 3947.0Wm^2 and 3537.95Wm^2 for pitch angle 0^{o}, 25^{o} and 45^{o} respectively. It concluded that, at 45^{o} the conductive heat flux is lower compared to the other pitch for both materials.

CHAPTER 1

INTRODUCTION

1.1 Background

Heat is transferred from a higher temperature object to a cooler temperature. There are three types of heat transfer; conduction, convection and radiation. According to Cowan (1973), around 13% of heat is transferred through conduction and convection, whereby 87% of heat transfer from the roof to occupant is through radiation process and 60% of thermal transfer occurs in the roof under tropical climates. In tropical countries, the greatest heat gain in low-rise buildings occur through the roof, since this is the surface most exposed to solar radiation. Therefore, the use of material to minimize the heat gain through a roof is necessary to reduce internal temperature (Caren Michels *et* al., 2006). Higher roof pitch angles with a large roof space volume could reduce the temperature at roof space by 2°C and that of the space below by about 0.3°C (Zakaria *et al.*, 2002). On the other hand, according to Syiful Irwan (2009) stated the best roof angle for optimum thermal and energy performance in our local climate is 10°. It reduces 1.2°C for non insulated roof and 0.5°C for insulated roof with saved up to 0.79 kWh or 4.13% per day. However, there is no empirical mathematical relation between heat transfer and the characteristic of roofing material such as volume and pitch angle. Therefore this study is proposing to develop a mathematical relation via field data monitoring.