

New mathematical model of solar flux radiation for double-pitched roof surface

Abstract

The aim of this research is to simplify an existing model (model-1) of solar flux radiation containing many parameters as compared to a new mathematical model (model-2) using just two independent variables, time and roof's angle of inclination. The impact of the solar radiation on the surface of the roof in Sabah (state of Malaysia) has been examined under different orientations and slopes by means of model-1 at different time of the day. Furthermore, the data of solar flux radiation computed using model-1 has been explored to develop the model-2 from which the correlation coefficient of 0.87 was achieved using regression analysis. It has been proven statistically using the t-test that the difference between the existing model-1 and the proposed model-2 is not significant. The new mathematical model-2 developed can be applied for a double-pitched roof at any given orientation in the area of Sabah only, where the slope of the roof and the local time have to be taken from 0 to 75 degrees and from 7 hrs to 17 hrs, respectively. Additionally, the method used in the derivation of this new model can also be employed for other states of Malaysia as well as other countries. From a technical point of view, the architects or designers can use the proposed model for a quick estimation of solar flux radiation, to identify the type of insulations to be applied under the roof or above the ceiling, as well as the size area of the natural ventilation and the decision-making on the thermal system to be employed, either as an active or a passive cooling system. Copyright © 2008 The Berkeley Electronic Press.