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# THE ENERGY EFFICIENCY OF NATURAL SHADING WITH CLIMBING PLANTS

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## Abstract

The work presents the results in investigating the thermal behaviour of passive solar elements, for expanding the existing analysis and prediction methodologies. The interest focuses on solar control through natural shading with deciduous plants. This provides a natural path for incorporating all advantages the passive behaviour, available throughout the year. The simulation of the dynamic energy performance of building elements is developed, starting with a physical modelling of the various energy conversion and transport mechanisms (e.g., solar radiation, heat gains, convection and conduction), and followed by a numerical modelling of the considered physical effects. An experimental investigation of using plants as a passive solar system for solar control of building elements by natural shading is carried out. Along these lines, an experimental model is designed consisting of a test cell having its southern façade partially shaded by plants, and a set of instruments - placed at the shaded and at the sunlit wall area - is used, which is supported by a data-acquisition system. Several physical parameters for a hot summer period are measured, allowing both the experimental validation of the developed simulation programme and the comparison of the results on heat transmission obtained through theoretical predictions and through measurements. Profiles of the daily measured solar radiation components and of the temperatures on the wall surfaces taken on days with high sky clearness showed a very good agreement with the predicted values. Comparisons of the temperatures on the shaded and on the sunlit wall surface showed that plants constitute an excellent passive system for solar control in buildings, offering significant advantages over conventional artificial sunscreens.

*Key words:* natural shading, passive solar control, simulation

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