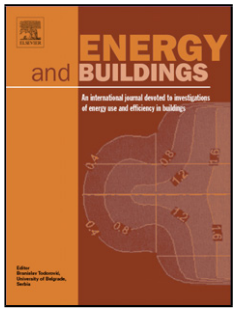

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Free convection heat transfer from a window glazing with an insect screen

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Research Highlights

- Results from a CFD model with insect screen treated as a layer of porous medium
- Model validated against published measurements
- Insect screens can reduce the free convective heat transfer rate up to 50%
- A general correlation for average Nusselt number is presented

ABSTRACT

A numerical study is conducted of laminar free convection from a vertical window glazing adjacent to an insect screen which is modeled as a layer of porous medium. The numerical results are validated against optical temperature field visualization and local heat flux measurements. The numerical model is also shown to agree well with established correlations for the heat transfer at the upper and lower asymptotic limits of screen permeability. Results are presented for Rayleigh number (based on the glazing height) of $Ra_H=10^6$ - 10^9, and for window height to screen spacing ratios, H/W=25, 60 and 100. Under some conditions, the flow resistance of an insect screen is found to reduce the convective heat transfer rate from the glazing by more than 50%. Generally, it was found that the screen has less effect on the convective heat transfer rate as the Rayleigh number increases. Also, in the range of parameters corresponding to most practical window applications, decreasing the screen to window spacing reduces the convective heat transfer rate from the glazing. A general correlation for use in window analysis is presented that accounts for the effect of an insect screen on the average convection coefficient at the glazing.