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Presenting: Advanced Modeling of Enclosed Airspaces to Determine Thermal Resistance for Building Applications

The Reflective Insulation Manufacturers Association International (RIMA-I) is proud to share information on a recently published open-access paper by Dr. Hamed Saber of the Royal Commission for Jubail and Yanbu, Kingdom of Saudi Arabia and Dr. David Yarbrough of R&D Services, Inc., in Watertown, Tennessee.

The paper is titled "Advanced Modeling of Enclosed Airspaces to Determine Thermal Resistance for Building Applications" and acknowledges enclosed airspaces to reduce heat flow have been recognized for well over 100 years. Airspaces with one or more reflective surfaces define reflective insulation (RI) assemblies, a product type used in walls, roofs, windows with multiple panes, curtain walls and skylights. The thermal resistance (R value) of airspaces depends on the emittance of all surfaces, airspace dimensions and orientation, heat flow direction and surfaces temperatures. The modeling of RI now includes CFD coupled with radiation to quantify the total heat transfer.

This study compares a validated model for airspace R values with existing methods such as ISO 6946 and hot-box results that provide the R values in the ASHRAE Handbook of Fundamentals. The existing methods do not include an airspace aspect ratio. This study showed that the aspect ratio can impact the R value by a factor of two. The impact of aspect ratio was calculated for double airspaces variation such as that for single airspaces. The present calculations are two-dimensional and also consider all the bounding airspace surfaces, while previous methods are one-dimensional and do not include surface temperature variations or detailed radiative transport.

The full report is available here: https://www.mdpi.com/1996-1073/14/22/7772.