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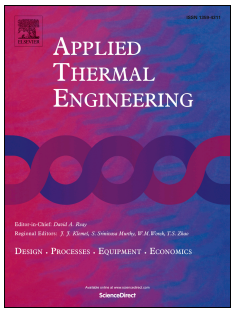


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# Modelling of a Rotary Desiccant Wheel: Numerical Validation of a Variable Properties Model

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## Abstract

Desiccant cooling systems have been used since the early '30s, mainly for industrial applications in which significant economic benefits could be achieved from an accurate humidity control. The core unit of a desiccant cooling system is the desiccant wheel device, the performances of which determine size and cost of the whole system. As a result, having a good desiccant wheel mathematical model can be an useful tool to optimize the operation of the device, as well as a valuable aid in the design phase.

In this paper a one-dimensional coupled heat and mass transfer desiccant wheel model was developed, taking into account the dependence of thermodynamic and transport properties of humid air with temperature (Variable Properties Model, VPM). The model has been validated using both literature and experimental data in terms of temperature and humidity profiles at the exit of the wheel, dehumidification effectiveness, dehumidification coefficient of performance and sensible energy ratio.

Compared to the traditional models, significant improvements in the agreement between numerical predictions and experimental data have been observed. It was found that mean relative error between measured and VPM calculated data were always significantly lower than those between the same experimental data and values calculated according to widespread literature models which consider moist air properties constant with temperature; as a consequence, it can be inferred that

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