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VALIDATING ANSYS HEAT TRANSFER MODELS USING EXPERIMENTAL DATA ANALYSIS OF TWO PHASE CHANGE MATERIALS WITH DIFFERING MELTING TEMPERATURES

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Abstract – Phase change materials are becoming more and more popular as viable options for improving the thermal performance and energy efficiency of a variety of applications, especially in innovative building envelope designs. In this paper, experimental data from two different phase change materials with differing melting temperatures (21 °C and 28 °C) are used to validate numerical system heat transfer models. The experimental setup included a heat flux apparatus, which was utilized to ascertain average temperature and heat flow changes over time during both heating and cooling phases for both phase change materials. The data obtained from the experiments were utilized to generate ANSYS Fluent simulation models replicating the experimental setup. The parameters and boundary conditions for the models can be assigned in several ways within ANSYS Fluent software. Consequently, two simulation models were created: one integrated the thermal and physical properties of the experimental setup's system components, while the other utilized the measured heat-flux values over time from the experiments as an input source for calculating average temperatures within the phase change material. The average temperature data from both simulation and experimental results were compared to validate both ANSYS models. By aligning the simulated results with the experimental data, the accuracy and reliability of the numerical models have been established in predicting the thermal behaviour of the two phase change materials. The two numerical system heat transfer models developed in this study serve as valuable tools for conducting further analysis and optimization of systems based on phase change materials. This research highlights the significance of phase change materials in enhancing the thermal performance of building envelopes, particularly in solar energy applications.

Keywords – ANSYS Fluent; heat flux apparatus; numerical models; phase change materials; thermal performance