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A Simulation Study for Evaluating the Performances of Different Types of House-hold Radiant Air Conditioning Systems

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Abstract

As one potential solution of independent temperature and humidity control in small-to-medium scaled residential buildings, systems of outdoor air dehumidifier with radiant terminals attracted lots of researchers' interests. In this paper, three types of house-hold radiant air conditioning (A/C) systems, a conventional air source heat pump (ASHP) based, a high-temperature ASHP based and a novel variable refrigerant flow rate (VRF) based radiant A/C system, were proposed. Simulation models for three systems were established using Energy Plus. A prototype of the VRF based radiant A/C system was built and tested in an existed psychometric room. Testing results were compared with the simulated results showing that the average relative errors between them were less than 8%. Therefore, simulation studies were carried out to evaluate the energy performances of the three types of house-hold radiant A/C systems. Compared to the conventional ASHP based system, the high-temperature ASHP based system achieved 14.99% annual energy saving and the VRF based system 19.34%. Therefore, the VRF based system achieved the best energy efficiency, providing a promising solution for the house-hold radiant A/C system to realize the independent control of temperature and humidity in small-to-medium scaled

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