

Heat Transfer by a Briefcase-shaped Air Cooler Using Thermoelectric Cooling Technology: A Case Study

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Abstract - In this paper, a unique briefcase-shaped air cooler has been proposed. Since the thermoelectric cooler is becoming one of the promising alternatives to a typical refrigeration system; therefore, thermoelectric cooling technology has been considered for the proposed air cooler system. In this work, a detailed experimental work has been demonstrated including COP calculation and uncertainty calculation. The experimental results show that the 6-channel heat exchanger is a good fit for the proposed air cooler which reduces the air temperature around 1.5 °C more compared to the 10-channel heat exchanger, due to its higher contact surface area for heat exchange. The proposed system has been also tested using two different sizes of the prototype room. It is noticed that the temperature drops 5°C from ambient temperature inside the small room while it keeps the room temperature the same at around 22.5 °C when using a 100W heat source inside the room. Furthermore, room temperature comes down at 20 °C and remains the same as ambient temperature with and without additional heat source due to better heat dissipation in a larger area. The calculated coefficient of performance of the proposed system is 0.3 using only 365 W electrical power input.

Keywords: Air cooling system; thermoelectric cooling; coefficient of performance; heat source.