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Improvement of Heat Pipe Thermal Performance in H-VAC Systems Using CFD Modeling

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Abstract : Heat pipe is simple heat transfer device which combines the conduction and phase change phenomena to control the heat transfer without any need for external power source. At hot surface of heat pipe, the liquid phase absorbs heat and changes to vapor phase. The vapor phase flows to condenser region and with the loss of heat changes to liquid phase. Due to gravitational force the liquid phase flows to evaporator section. In HVAC systems the working fluid is chosen based on the operating temperature. The heat pipe has significant capability to reduce the humidity in HVAC systems. Each HVAC system which uses heater, humidifier or dryer is a suitable nominate for the utilization of heat pipes. Generally heat pipes have three main sections: condenser, adiabatic region and evaporator.Performance investigation and optimization of heat pipes operation in order to increase their efficiency is crucial. In present article, a parametric study is performed to improve the heat pipe performance. Therefore, the heat capacity of heat pipe with respect to geometrical and confining parameters is investigated. For the better observation of heat pipe operation in HVAC systems, a CFD simulation in Eulerian- Eulerian multiphase approach is also performed. The results show that heat pipe heat transfer capacity is higher for water as working fluid with the operating temperature of 340 K. It is also showed that the vertical orientation of heat pipe enhances it’s heat transfer capacity used in the abstract.

Keywords : heat pipe, HVAC system, grooved heat pipe, CFD simulation
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