World Academy of Science, Engineering and Technology
International Journal of Energy and Environmental Engineering
Vol:13, No:02, 2019

A Theoretical Analysis of Air Cooling System Using Thermal Ejector under Variable Generator Pressure

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Abstract : Due to energy and environment context, research is looking for the use of clean and energy efficient system in cooling industry. In this regard, the ejector represents one of the promising solutions. The thermal ejector is a passive component used for thermal compression in refrigeration and cooling systems, usually activated by heat either waste or solar. The present study introduces a theoretical analysis of the cooling system which uses a gas ejector thermal compression. A theoretical model is developed and applied for the design and simulation of the ejector, as well as the whole cooling system. Besides the conservation equations of mass, energy and momentum, the gas dynamic equations, state equations, isentropic relations as well as some appropriate assumptions are applied to simulate the flow and mixing in the ejector. This model coupled with the equations of the other components (condenser, evaporator, pump, and generator) is used to analyze profiles of pressure and velocity (Mach number), as well as evaluation of the cycle cooling capacity. A FORTRAN program is developed to carry out the investigation. Properties of refrigerant R134a are calculated using real gas equations. Among many parameters, it is thought that the generator pressure is the cornerstone in the cycle, and hence considered as the key parameter in this investigation. Results show that the generator pressure has a great effect on the ejector and on the whole cooling system. At high generator pressures, strong shock waves inside the ejector are created, which lead to significant condenser pressure at the ejector exit. Additionally, at higher generator pressures, the designed system can deliver cooling capacity for high condensing pressure (hot season).

Keywords : air cooling system, refrigeration, thermal ejector, thermal compression
Conference Title : ICEECP 2019 : International Conference on Energy, Environmental and Climate Policy
Conference Location : Kuala Lumpur, Malaysia
Conference Dates : February 11-12, 2019