LOW GRADE WASTE HEAT RECOVERY USING THERMOELECTRIC GENERATOR

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ABSTRACT

This project is focused on using the thermal design techniques to obtain the optimum design of a thermoelectric generator used to recover low-grade heat waste and then applied the design to the external unit of the air conditioner. Optimizing the design by optimize the heat sink and thermoelectric generator. Heat sink optimization can be done by optimize heat sink efficiency, the heat transfer coefficients and the heat transfer area of the heat sink. Optimizing thermoelectrics can be done by optimizing load resistance simultaneously with either the number of thermocouples (n) or geometric ratio. Two experiments have been carried out, air to air and air to liquid. Each experiment was compared with three things, optimum design, theoretical results, experimental results. The result of air to liquid's optimum design using 168 modules about 1 Watt.

Keywords: waste heat recovery , thermoelectrics, thermoelectric generator

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INTRODUCTION

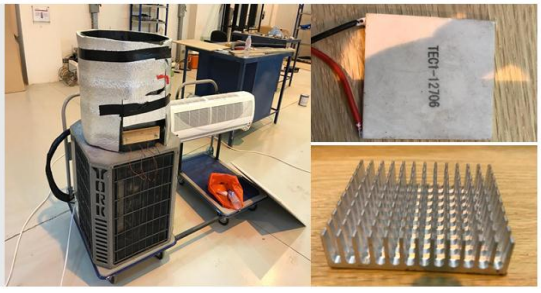
Waste heat is heat rejected or escaped from any heat engine system. The meaning of waste heat recovery is to reuse the waste heat In order to improve the efficiency by 10% to as much as 50% in some industrial equipment such as furnaces. There are different ways to recover the wasted heat one of them is by using thermoelectric generator. In this project we used thermoelectric generator to recover some of the wasted heat that come out of the air conditioner out side unit. Thermoelectric generator is a solid state device that can directly convert thermal energy to electrical power. It has two sides where one of them is cold and the other is hot and in between there are two dissimilar wires. Duo to its solid state feature, thermoelectric generator device needs no moving parts which gives it the advantage of high reliability and scalability. However, the disadvantages of thermoelectric generator converge as highly cost and low efficiency.

PROJECT OBJECTIVES

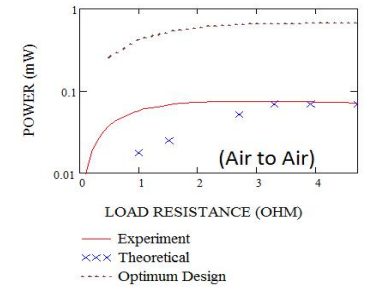
The aim of our project is recover some of the wasted heat .We measure the amount of wasted heat and the power we get from the thermoelectrics to know the percentage we got from the wasted heat.

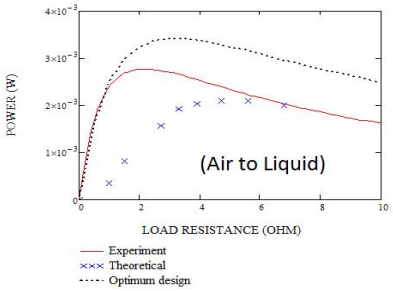
PROJECT FRAMEWORK / METHODOLOGY

We assumed the system is steady state and one dimension where the heat transfers from the high temperature to the lower in one direction. We use effective material properties equations to accumulate the errors associated with neglecting the contact resistant .



FIGURES / CHARTS / TABLES





RESULTS AND DISCUSSION

Based on the experiment result we found that the maximum power that comes from this module (TEG1-12706) in air to air experiment about 0.07mW, and the maximum power from air to liquid 2.6mW by using only three thermoelectric modules. We can use more than 180 modules to generate about 470Mw under the same conditions in air to liquid experiment.

		Load Resistance (Ω)	Hot Junction Temperature (°C)	Cold Junction Temperature (°C)	Max. Power (W)	Total Power (W)
Air to Air	Prediction	2.926	44.479	43.983	7.561×10⁻⁵	0.015
	Experiment	5.8	NA	NA	7.014×10⁻⁵	0.012
	Optimum design	6.667	44.11	42.277	7.188×10⁻⁵	0.121
Air to Liquid	Prediction	2.158	43.806	40.86	2.771×10⁻³	0.466
	Experiment	5.8	NA	NA	2.25×10⁻³	0.376
	Optimum design	0.801	44.312	40.179	5.92×10⁻³	0.995

CONCLUSION AND RECOMMENDATIONS

In this project we used thermoelectric generator to recover some of the wasted heat that come out of the outside unit of the air conditioner. Based on the two experiment that we did we found out that the maximum power that we got is from air to liquid experiment. This project can be developed by using the proper module of thermoelectric or even design a custom module.

REFERENCES

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