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指導教員 承認印	主	副	副
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学位（博士）論文要旨

(Doctoral thesis abstract)

論文提出者 Ph.D. Candidate	生物システム応用科学府 生物システム応用科学専攻 博士後期課程 生物機能システム科学 専修/グループ 平成 25 年度入学 氏名 FARIKHAH, IRNA ㊞				
主指導教員 氏名 Chief Advisor's Name	上田祐樹	副指導教員 氏名 Vice Advisor's Name	秋澤淳	副指導教員 氏名 Vice Advisor's Name	石田寛
論文題目 Title	Optimization of a heat-driven thermoacoustic cooler in a looped tube with two stacks				

論文要旨（和文要旨(2000字程度)または英文要旨(500words)）

Optimization of a heat-driven thermoacoustic cooler has been described. The thesis consists of seven chapters. In chapter 1, the thermoacoustic systems, a thermoacoustic engine, a thermoacoustic cooler, and a heat-driven thermoacoustic cooler, are introduced.

In chapter 2 is about the fundamental concept of the thermodynamic and the thermoacoustic theory. The used thermoacoustic theory was proposed by Rott. The derivation of the momentum and continuity equations in the Rott's theory was followed.

In chapter 3, the used transfer matrices were introduced. Two different types of transfer matrices were used; transfer matrix with constant temperature and transfer matrix with different temperature. One is used for a waveguide and the other is used for a stack that is the core component of the cooler.

The transfer matrix method was validated with some experimental results in chapter 4. Good agreements between numerical and experimental results were shown.

In chapter 5, the optimization was conducted. The optimization is based on the Yazaki's experimental setup, which was reported in 2002. In the optimization, the transfer matrices were used to calculate the efficiency of the engine stack, the cooler stack, the looped tube, and the whole of the cooler. In this optimization, five parameters were optimized using three cycle optimization. They are the relative position of the cooler stack, the radius of the engine stack, radius of the cooler stack, porosity of the engine and porosity of the cooler stack. First, the optimization of the relative position of the stack was performed with keeping radii of the stacks at 0.27 mm. These radii were the same to those of the Yazaki's experimental setup. Second, the radii of the stacks were optimized simultaneously with keeping the relative position at the optimum value, 0.54. Finally, using the optimum value of relative position and radii of the stacks, the porosities of the stacks were optimized. It was found that the optimum relative position, radius of the engine stack, radius of the cooler stack, porosity of the engine and porosity of the cooler were 0.54, 0.96, 1.06 and 1.3, respectively. In addition, it was found that the numerical optimization of the parameters made the second-law efficiency of the engine, and cooler were 0.82 and 0.56 of the upper limit value. Moreover, the efficiency of the tube became 0.63. Furthermore, in this chapter, the total efficiency of the cooler was also calculated. It was found that the total efficiency to be 0.24 of the upper limit value. Using three cycle optimization, the optimum values were still same to those of the first cycle.

In chapter 6, re-calculation of the optimized value was performed. In this case, we calculated using new method which the flow-path model of the stacks is non-uniform. I showed that using the new

method, the total efficiency of the whole cooler was decreased from 0.24 to 0.21 of the upper limit value. In the last chapter, the conclusion of this investigation was described.

（英訳） ※和文要旨の場合(300 words)

If the abstract is written in Japanese, needed to translate into English.(300 words)