2020 年度研究活動報告
Research activities in 2020

理工学術院総合研究所　鄭 宗秀
Jongsoo Jeong, Waseda Research Institute for Science and Engineering

ジャーナル論文，Publications

・Mark Anthony Redo, Jongsoo Jeong, Seiichi Yamaguchi, Kiyoshi Saito, Hyunyoung Kim, Mark Anthony Redo, Jongsoo Jeong, Niccolo Giannetti, Koji Enoki, Seiichi Yamaguchi, Kiyoshi Saito, Characterization and improvement of flow distribution in a vertical dual-compartment header of a microchannel heat exchanger, International Journal of Refrigeration, Aug. 2020, Vol.116, P.36-48.

・Prediction of Two-Phase Flow Distribution in Microchannel Heat Exchangers Using Artificial Neural Network, Niccolo Giannetti,Mark A Redo, Sholahudin Sholahudin, Jongsoo Jeong, Seiichi Yamaguchi, Kiyoshi Saito, Hyunyoung Kim, International Journal of Refrigeration, 2020.3, Vol.111, P.53-62.

学会発表論文，Conference papers & Seminars

・Hifni M. ARIYADI, Niccolò GIANNETTI, Jongsoo JEONG, Seiichi YAMAGUCHI, Kiyoshi SAITO, Changhoon LEE, Jungtae KIM, Seungbeom LEE, Jiyong LEE, and Kwangyeol JEONG, Flow Characteristics and Noise Diagnosis of Hydrogen Charging Solenoid Valve in Hydrogen-Fueled Automobile, ECOS 2020, Jun.2020, Osaka, Japan.

・Hifni Mukhtar Ariyadi, Niccolo Giannetti, Jongsoo Jeong, Seiichi Yamaguchi, Kiyoshi Saito, Seungbeom Lee, Jiyong Lee, Kwangyeol Jeong, Euidong Ro, Jaebeom An, Noise Diagnosis　in Solenoid Valve inside Hydrogen Tank Solenoid System during Refuelling, 2020 JSAE Congress, Oct. 2020, Tokyo, Japan.

・鄭 宗秀(早稲田大学)，宮岡 洋一，西山 教之，Giannetti Niccolo，山口 誠一，齋藤 潔, 低 GWP 冷媒を採用した次世代冷凍空調技術の実用化評価に関する研究開発 第３報：シミュレーター開発, 2020 年度 日本冷凍空調学会年次大会, 2020,9.

・宮岡 洋一，西山 教之，ジャンネッティ ニコロ，鄭 宗秀，山口 誠一, 齋藤 潔, 榎木 光治，井上 洋平，清 雄一，湊 明彦，関口 通江, 低 GWP 冷媒を採用した次世代冷凍空調技術の実用化評価に関する研究開発 第２報：2019 年度の取り組みと成果, 2020 年度 日本冷凍空調学会年次大会, 2020,9.

・田中 裕樹，Giannetti Niccolo，Jongsoo Joeng，宮岡 洋一，齋藤 潔，法福 守，高藤 亮一，平田 匠弥, マイクロチャンネル熱交換器の最適設計に関する研究, 2020 年度 日本冷凍空調学会年次大会, 2020,9.

・市川 暁広, 鈴木 隆起, 鄭 宗秀, 宮岡 洋一, 齋藤 潔, 産業用ヒートポンプシステムの統合シミュレーション技術の構築 第 2 報：「産業用ヒートポンプ単体シミュレータ」の開発, 2020 年度 日本冷凍空調学会年次大会, 2020,9.

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Research Summary

I have focused on the characteristics analysis of flow phenomena and the enhancement of the working fluid distribution performance in microchannel heat exchanger header, and the

correlation among refrigerant charge amount, heat exchanger performance and system operation to evaluate the energy saving of actual system by utilizing next generation refrigerant. One of the indispensable elements produced from the development of microfluidic technologies is the microchannel heat exchanger (MCHX), which its compactness gives the advantage of saving materials and production cost, saving space, as well as of reduction in refrigerant charge.

In 2020, we studied the basic flow characteristics for straight type header to clarify the effect of refrigerant flow by centrifugal force for spiral type header, and discussed an alternative method in formulating the correlation from the analogy to electric circuits and Prigogine's theorem of minimum dissipation. In this manner, being derived from a physical representation, a higher degree of accuracy and, possibly, broader applicability were achieved.

And, we developed the simulation technology for system optimization with the aim of achieving the development goals of the high-temperature heat pump.

In particular, we have built a highly versatile industrial heat pump simulator by enhancing the GUI so that it can flexibly respond to changes in refrigerants, systems, and operating conditions. Simulations were conducted for several model cases to which this high-temperature heat pump was applied, and the effects of introduction were examined.

Besides, we investigated noise issue generated from high pressure hydrogen gas flow inside the Hydrogen Tank Solenoid System (HTS). Both computational model and experimental measurement were conducted to investigate flow-induced noise caused by hydrogen flow characteristics inside HTS, particularly the one generated in solenoid valve during charging and using. The results revealed that without any treatment, the noise generated inside the solenoid valve can be extremely loud and thus may give negative effect to devices and users, mainly caused by severe turbulent at downstream of the valve.