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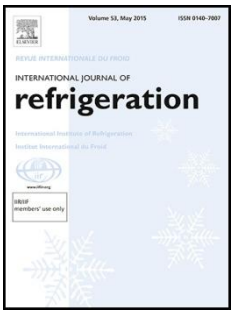

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Author: Taijong Sung, Yoon Jo Kim, Hwa Soo Kim, Jongwon Kim

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Empirical modeling and robust control of a novel meso-scale vapor compression refrigeration system (mVCRS)

Taijong Sung[1, +], Yoon Jo Kim[2, +], Hwa Soo Kim[3, *], and Jongwon Kim[1]

[1] School of Mechanical and Aerospace Eng., Seoul National University, Seoul 08826, Republic of Korea

[2] Dept. of Mechanical Eng., Washington State University Vancouver, Vancouver, WA 98686, USA

[3] Dept. of Mechanical System Eng., Kyonggi University, Gyeonggi-do 16227, Republic of Korea

[*] Corresponding author, Tel: +82 31 249 9806, Fax: +82 31 244 6300, E-mail: hskim94@kgu.ac.kr (H. S. Kim)

[+] Both of these authors contributed equally to the work in this paper

Research highlights

- A "real" meso-scale vapor compression refrigeration system (mVCRS) is constructed.
- The dynamics of mVCRS is explored by an empirical system identification technique.
- The robust controller for the mVCR is successfully designed.
- The high cooling capacity and good temperature tracking of mVCRS are demonstrated.

Abstract

This paper presents an empirical modeling and robust control of a novel meso-scale vapor compression refrigeration system (mVCRS). The objective of this study is to maintain a temperature of heat source via the mVCRS against the cooling loads varying from 30 W to 80 W. To this end, the proposed mVCRS is identified by using a black-box model under various cooling loads and the robust control system is chosen to achieve the desired cooling capacity and the temperature tracking capability. For various cooling loads, the experiments using the mVCRS are carried out, which demonstrate that even for its compactness, the maximum cooling load of proposed mVCRS is 80 W with maintaining the temperature of the heat source around 46 °C with the help of a robust controller and, the temperature of heat source converges to the desired one within 70 sec and is minimally bounded by 1.25 °C irrespective of the cooling load.

***Keywords*:** meso-scale, vapor compression refrigeration, black-box model, multiplicative uncertainty, robust control.