부산대학교
PUSAN NATIONAL UNIVERSITY

# Thermal Management & Control Lab.

**Prof. HAKSOO KIM**

**Pusan National University**
**School of Mechanical Engineering**

# Introduction (Principal Investigator)



1. Name : Haksoo Kim

2. Educations
- BS (2009. 02) : Department of Mechanical and Aerospace Engineering, Seoul National University
- MS (2011. 02) : Department of Mechanical and Aerospace Engineering, Seoul National University
- Ph. D (2015. 02) : Department of Mechanical and Aerospace Engineering, Seoul National University

3. Job Experiences
- Doosan Enerbility (2015. 04 ~ 2017. 03) : Senior Researcher
- Korea Atomic Energy Research Institute (2017. 04 ~ 2020. 12) : Senior Researcher
- Korea Institute of Machinery & Materials (2021. 01 ~ 2025. 08) : Senior Researcher
- Pusan National University (2025. 09 ~ Present) : Assistant Professor

4. Publications
- SCI(E) papers : 13 (first author : 9, co-author : 4)
- Patents : 23 ↑ (Registered : 15 ↑)

5. Research Interests : Heat Pump System, Digital Twins, Control logic development

# Thesis

1. Master (Supervisor : Prof. Minsoo Kim)
   - An Experimental Study on Fault Detection and Diagnosis (FDD) Method Using Nonlinear Regression Model for Variable Refrigerant Flow (VRF) Multi-Heat Pump System

2. Ph. D (Supervisor : Prof. Minsoo Kim)
   - Studies on the Oil Retention and Performance of Oil Separator in Multi Heat Pump System

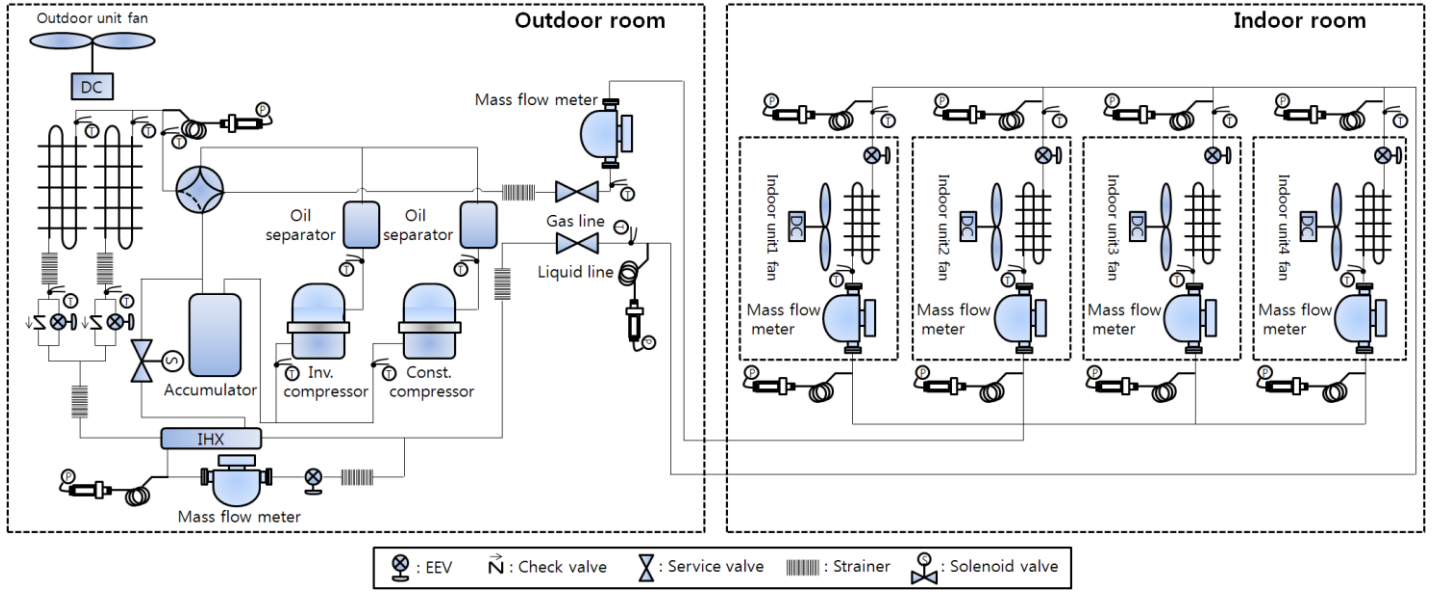



Fig. Schematic Diagram of Multi Heat Pump System

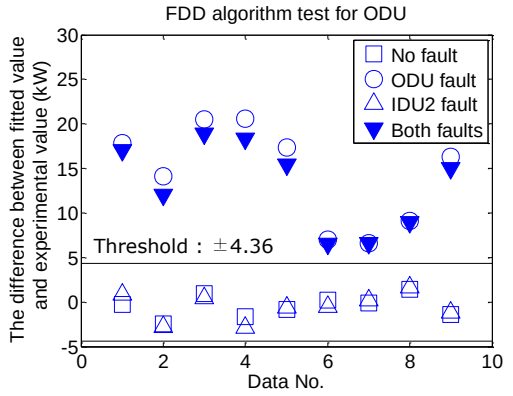



Fig. FDD results

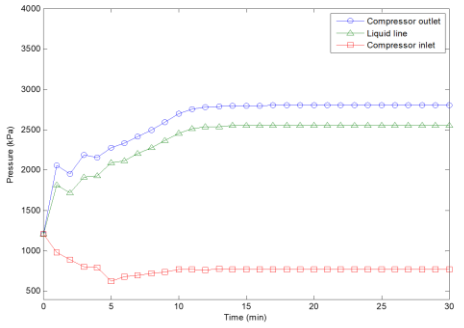



Fig. Dynamic Simulation

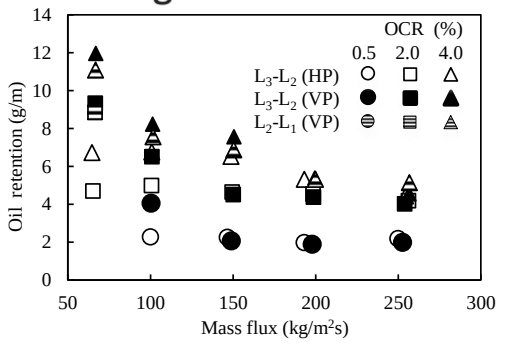



Fig. Oil Retention Results

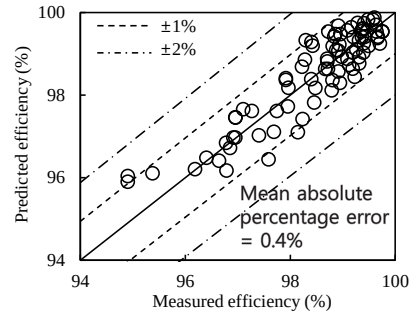



Fig. Oil Separator Results

# Job Experiences

## 1. Doosan Enerbility

- Design of supercritical $CO_2$ power plant for waste heat recovery system
- Target process : cement plant (PH boiler : 250℃ & AQC boiler : 300℃)
- Cycle optimization program for WHRS (Using Matlab)
- System performance analysis (design and part load condition)
- Domestic & US patents : 6 (registered)

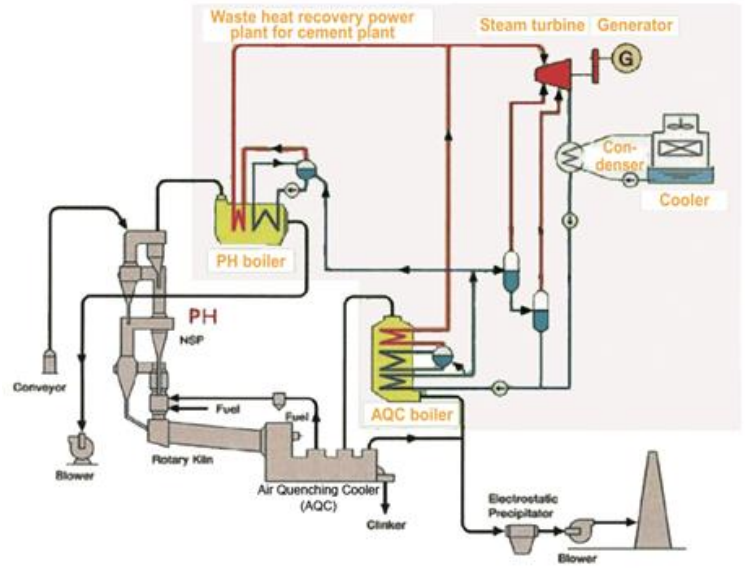



Fig. Schematic Diagram of Cement Plant

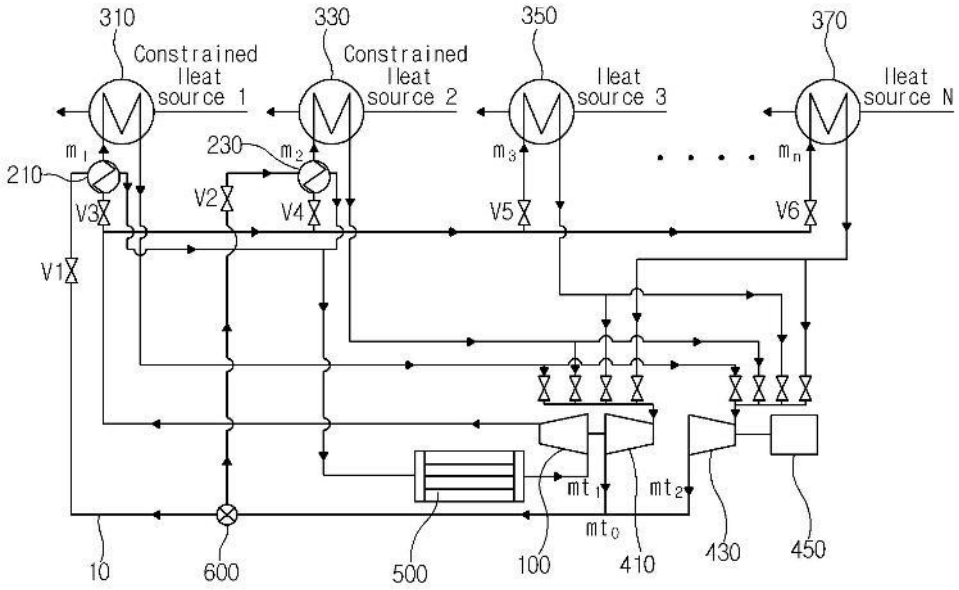



Fig. Schematic Diagram of Waste Heat Recovery System

# Job Experiences

## 2. Korea Atomic Energy Research Institute

- Dynamic modeling of small modular reactor (Dymola)
- Develop main control logics (Core power, temperature, pressure)
- System performance analysis for start up, shutdown & normal operation conditions
- Design of heat exchangers (steam generator, condenser)

* U. A. Bautista & R. B. M. Cervera, Technical Review and Status of Small Modular Reactor Technologies: Prospects of Nuclear Infrastructure Development in the Philippines, Energies, 2025.

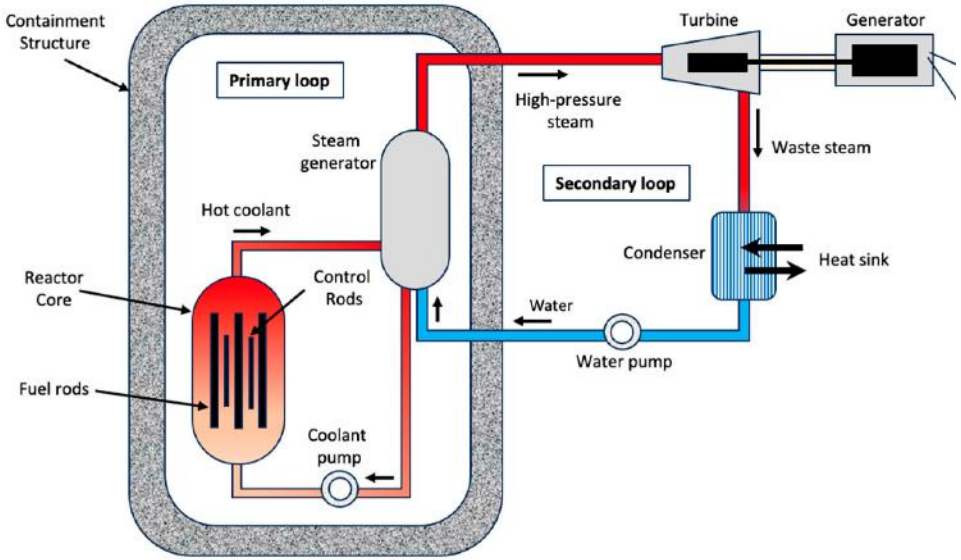



Fig. Schematic Diagram of Small Modular Reactor

* R. Hale et al., Dynamic Modeling of Small Modular Nuclear Reactors using MoDSim, Proceedings of the 10th International Modelica Conference, 2014.

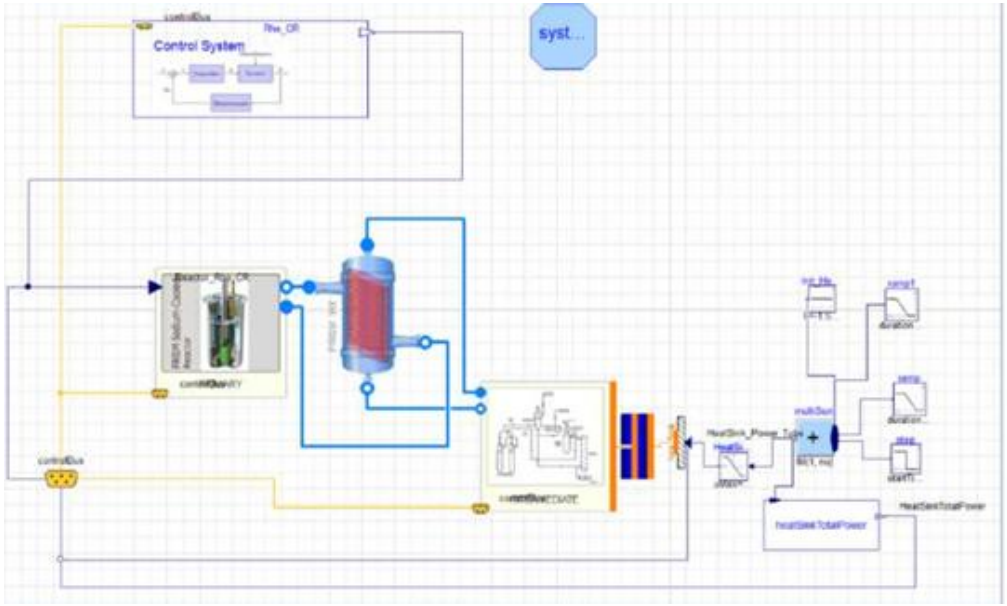
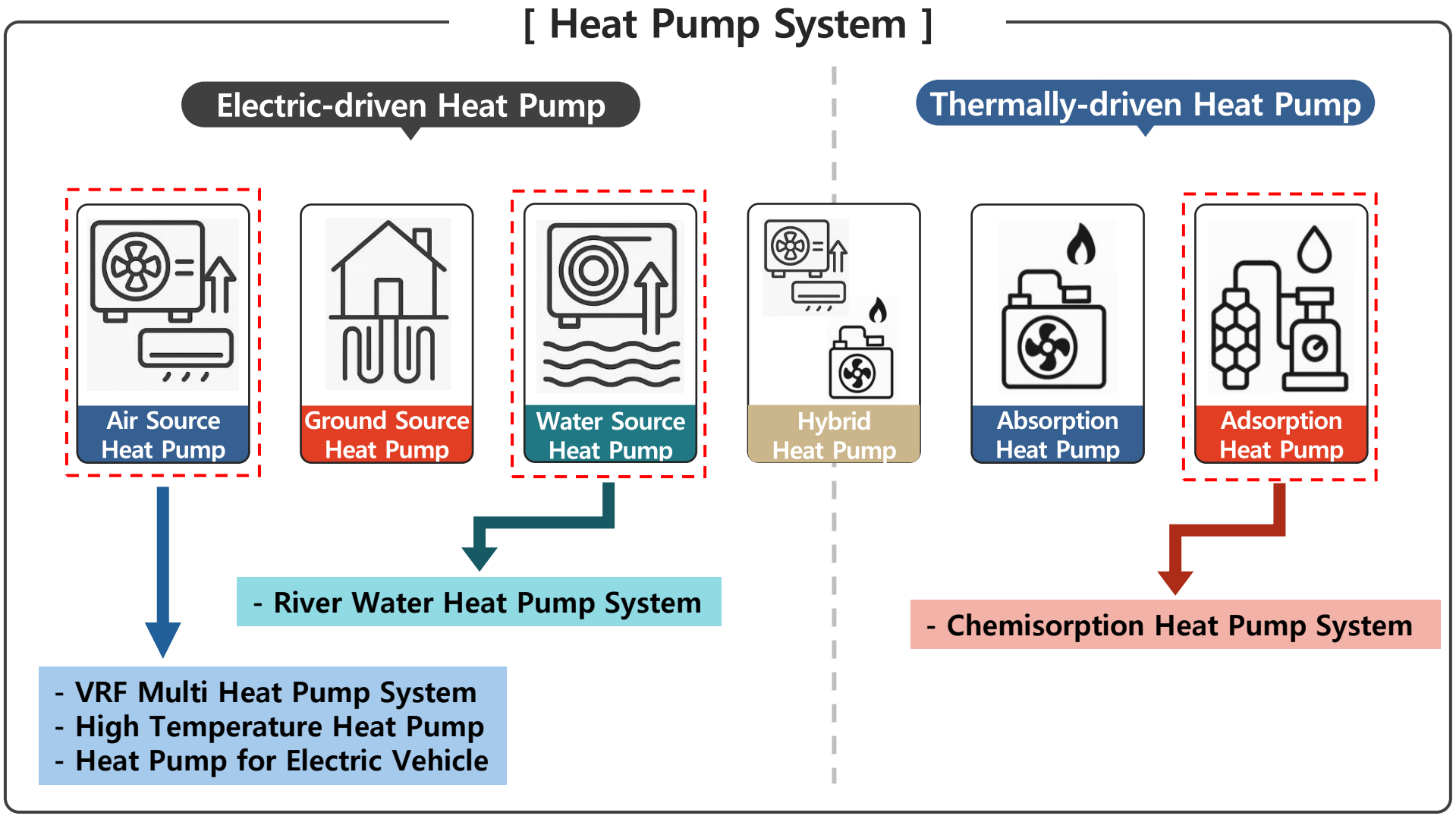



Fig. Schematic Diagram of 1-D Transient Model

## 3. Korea Institute of Machinery & Materials



# Job Experiences

## 3. Korea Institute of Machinery & Materials

- Chemisorption heat pump system : 1-D transient simulation & experimental research
- River water heat pump system : Experimental research & developing fouling model of plate heat exchanger
- Industrial heat pump system : 1-D transient simulation (Economical and environmental analysis)
- Low GWP refrigerant development : Flammability test (ASHRAE std.)
- Performance map of compressor and EXV for electric vehicle : Experimental test

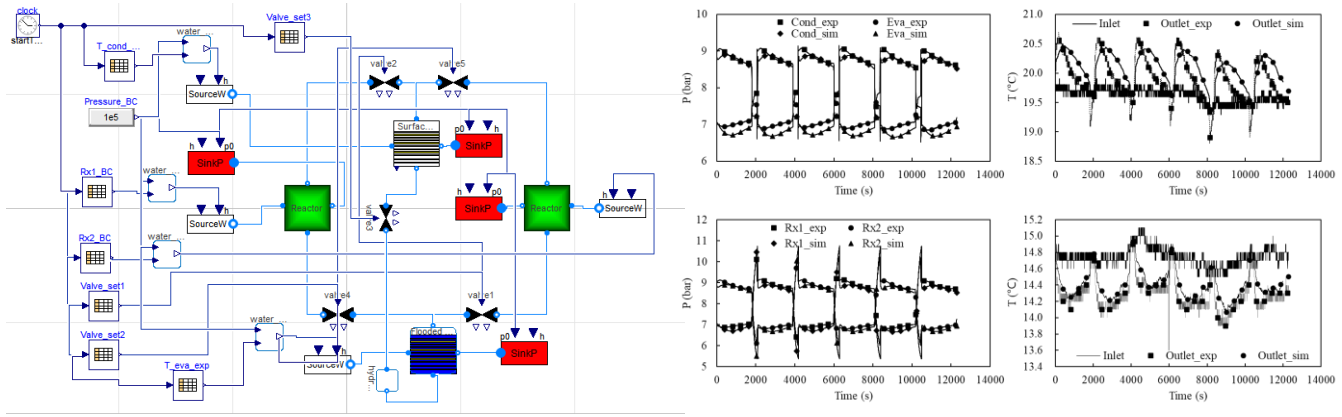



Fig. 1-D Transient Modeling of Chemisorption Heat Pump System


Fig. Experimental Test Rig. For Fouling Formation

# Research Interest



1. Thermal management system of electric vehicle
   - Developing 1-D transient model of TMS for EV : Design system configuration & control logic (MPC)
2. Digital twins for heat pump based thermal management system
   - Developing accurate and fast 1-D transient model and integrating it with actual system
3. Digital twins for heat pump based thermal management system
   - Large scale thermal management system (ex. Industrial heat pump, district heating & cooling, data center, …)

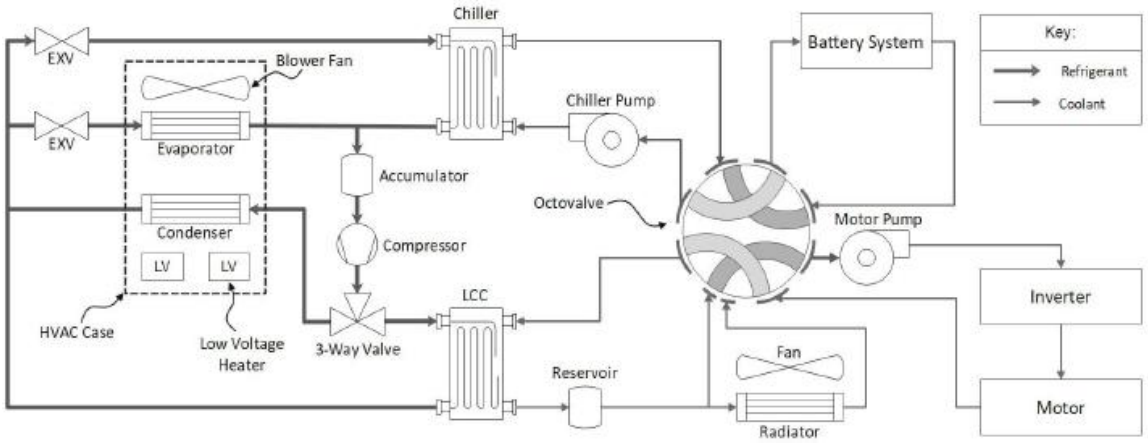



Fig. Schematic Diagram of Thermal Management System for EV

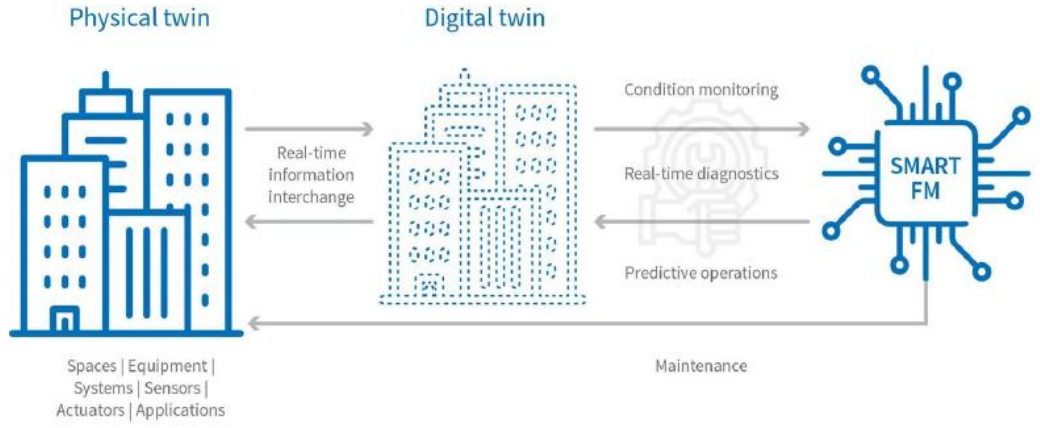



Fig. Schematic Diagram of Thermal Management System for EV