AUTOMATIC CONTROL SYSTEM FOR HEAT PUMP

User Guide

June 2020

Table of Contents

1 Installation and setup

1.1 Environment requirement

1.1.1 Test Environment

1. Python 3.7.0
2. TESpy 0.2.2
3. Git 2.21.0

1.2 Prerequisites

Key parts of this project require the following scientific software packages

1.2.1 Packages used

All the following packages can be installed by terminal

Command: “pip install …”

1. NumPy
2. Matplotlib
3. Pandas
4. Warnings
5. Math
6. Prettytable
7. Time

1.3 Installation

Type “git clone https://github.com/Tianhao-Y/Automatic-Control-System-for-Heat-Pump.git” in terminal

2 Sub-system usage

2.1 Room Model

2.1.1 Variables introduction

:param Printer: Print information or not --> boolean

:param room_temp: room temperature in Degrees Celsius --> float

:param environment_temperature: environment temperature in Degrees Celsius --> float

:param power: input heat pump power W --> float

:param method_heatpump: whether it is heater or not --> string "Heater" or "Cooler"

:return: the Update Temperature

2.1.2 Parameters introduction

r"""

:param density_a: air density in kg/m^3

:param capacity_a: the heat capacity of the air J/（kg·℃）

:param area: the size of the room in m^2

:param height: the height of the room in m

:param wall: The heat loss of the walls W/m^2*℃

:param window: The heat loss of the windows W/m^2*℃

:param ventilation: coefficient of ventilation W/m^3*℃

:param wallArea: the area of walls and windows should be a list --> [area_walls, area_windows] m^2

"""

2.1.3 How to change and print parameters

room = Room(room_temp, environment_temperature, power)

room.setRoomInfo()

room.getRoomInfo()

2.1.4 Usage

The output is the temperature after certain amount of time.

1. **Method 1:**

temp = roomTemp(room_temp, environment_temperature, power, method_heatpump, Printer)

2. **Method 2:**

room = Room(room_temp, environment_temperature, power)

temp = room.heatUp(Printer, method_heatpump)

If you have any another question in these part, please contact Tianhao (Tianhao.Yu@anu.edu.au)

2.2 Heat Pump Model

2.2.1 Parameters and Variables Declaration

pr1	Pressure ratio outlet 1	0.99
pr2	Pressure ratio outlet 2	0.98
amb_p.T	Groud source Temperature	12
amb_p.p	Groud source pressure	2
amb_out.T	Coolent Temperature	9
cp1.h0	flow entropy	1700
cd.ttd_u	upper terminal temperature difference of condersor	15
ev.ttd_l	lower terminal temperature difference of evaperater	5
su.ttd_l	lower terminal temperature difference of the heat exchanger	2
cb_dhp.T	input air flow Temperature	20
cd_cons.T	output air flow Temperature	Variable
eta_s	motor efficiency of the pumps	Variable
cons.Q	Output heat energy	Variable
design	Geometry independent friction coefficient heating loop	zeta2 :ζ/ 1 m4.

2.2.2 How to change Variables

```
Hp = HeatPump(q, eff, Temp)

r"""

    :param Temp: Temperature at the air outlet --> float

    :param q: q output

    :param eff: efficient of each part in pump

    """
```

2.2.3 Variables and Outputs declaration

r"""

:param state: the gears of the heat pump --> int 0 - 10

:param last_q: the heat output of last seconds --> float

:param method: type of String, should be 'heater' or 'cooler' to indicate the type of heat pump

:return: current heat output of the heat pump --> float

Power Consumption in total --> float

The efficiency of the heat pump COP --> float

Power Consumption for each part --> list

The efficiency of the Motor --> float

Temperature at the air outlet --> float

The heat output in current seconds --> float

"""

2.2.4 Usage

1. **Method 1:**

Q, P_total, COP, P, eff, T, current_q = operation (state, last_q, method)

2. **Method 2:**

hp = HeatPump(Q_out, eff, T)

P, P_total, COP = hp.caculation()

If you have any another question in these part, please contact Tianhao (Tianhao.Yu@anu.edu.au)

2.3 Control system

2.3.1 Parameters and Variables Declaration

Parameters & Variables	**Declaration**	**Units**
date	Date	Day

room_t	Room temperature	Celsius
deamand	Demand temperature (User demand)	Celsius
price	Price forecast data (input .csv files)	dollars per hundred kilowatts
temp	Weather forecast data (input .csv files)	Celsius

2.3.2 How to change Variables

control= control(demand, date, room_t)

:param demand: User demand temperature of the room --> list

:param date: Specific date --> int

:param room_t: Temperature of the room --> float

:param price: Price forecast data --> float

:param temp: Ambient temperature --> float

2.3.3 Variables and Outputs declaration

:return control: the gears of the heat pump --> int 0 – 10

2.3.4 Usage

1. **Method 1:**

   control(demand,date,room_t)

If you have any another question in these part, please contact Zi'ang Liu (u5927429@anu.edu.au)