SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19OE219 BUILDING AUTOMATION

IV YEAR /VII SEMESTER

Unit 2- CONTROL LOOPS

Topic : Feedback Control Loops

Introduction

- Feedback control loops are essential components of HVAC (Heating, Ventilation, and Air Conditioning) systems.
- These control loops help maintain a comfortable indoor environment while optimizing energy efficiency.

Temperature Control Loop

- **Sensor:** A temperature sensor (thermostat) measures the current indoor temperature.
- **Setpoint:** The desired temperature (setpoint) is set by the building occupant or the building management system.
- **Controller:** The controller compares the current temperature to the setpoint and calculates the error (difference).
- **Actuator:** If the temperature deviates from the setpoint, the controller activates an actuator (e.g., a furnace, air conditioner, or a damper) to adjust the HVAC system's operation.
- **Feedback:** The sensor continuously provides feedback to the controller, allowing it to make continuous adjustments to maintain the desired temperature.

Temperature Control Loop

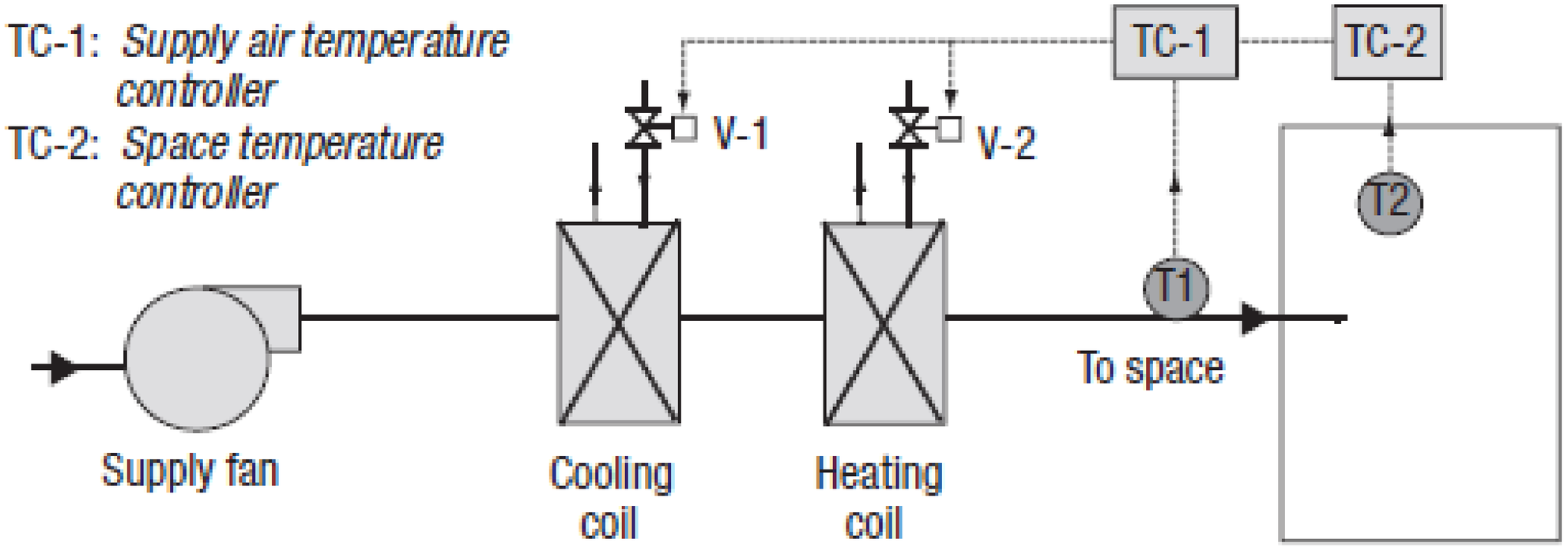


Figure 8.5 Schematic of temperature control of air-handling unit with water valves.

Humidity Control Loop

- Humidity control in a conditioned space is either for thermal comfort or industrial processes, which is done by controlling the amount of water vapour present in the air in the space.
- When relative humidity at the desired temperature set- point is too high, dehumidification is required to reduce the amount of water vapour in the air for humidity control.
- Similarly, when relative humidity at the desired temperature set- point is too low, humidification is required to increase the amount of water vapour in the air for humidity control.
- Commonly used humidification methods include: *water spray humidification* and *steam spray humidification*.

Humidity Control Loop

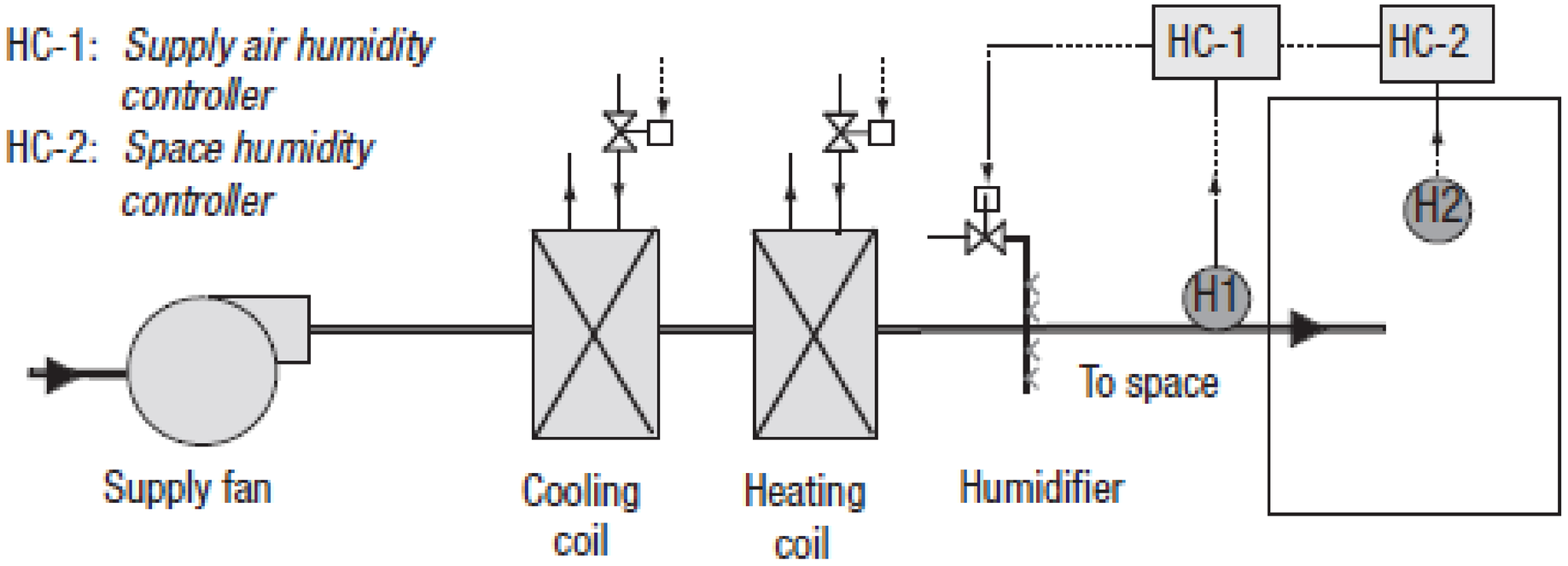
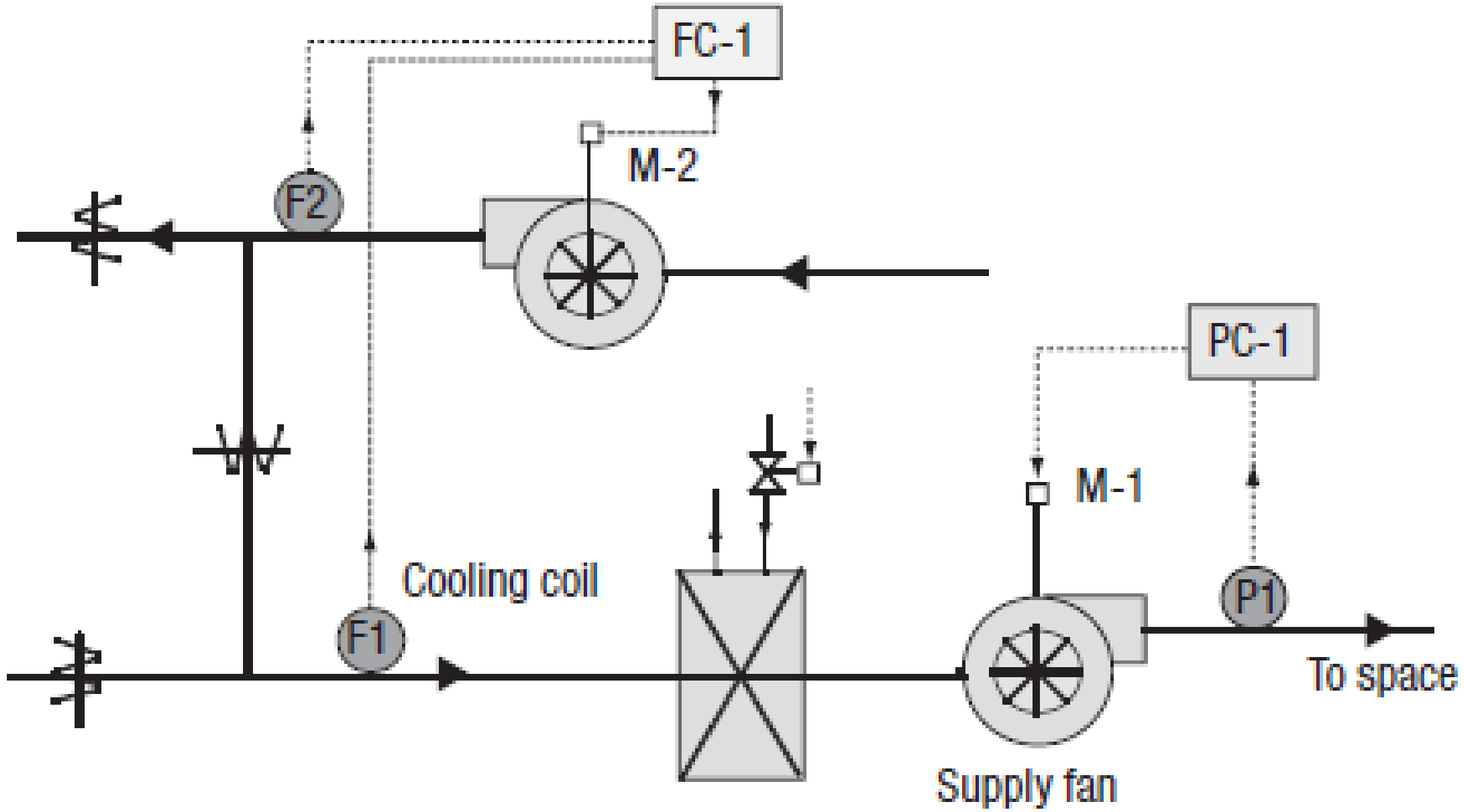


Figure 8.7 Schematic of humidity control of an air-handling system with steam spray.

Pressure Control Loop

- **Sensor**: Pressure sensors monitor air pressure in different zones of the HVAC system.
- **Setpoint**: Setpoints are established for different zones based on pressure requirements.
- **Controller**: Controllers adjust dampers or fans to maintain the specified pressure in each zone.
- **Actuator**: Dampers or fans are adjusted to control the air pressure in the system.
- **Feedback**: Pressure sensors provide feedback to the controller for continuous adjustment.

Pressure Control Loop



PC-1: *Static pressure controller*
FC-1: *Return air flow controller*
M-1, M-2: *Driver or frequency inverter*

Figure 8.8 Schematic of fan control of an air-handling system.

Airflow Control Loop

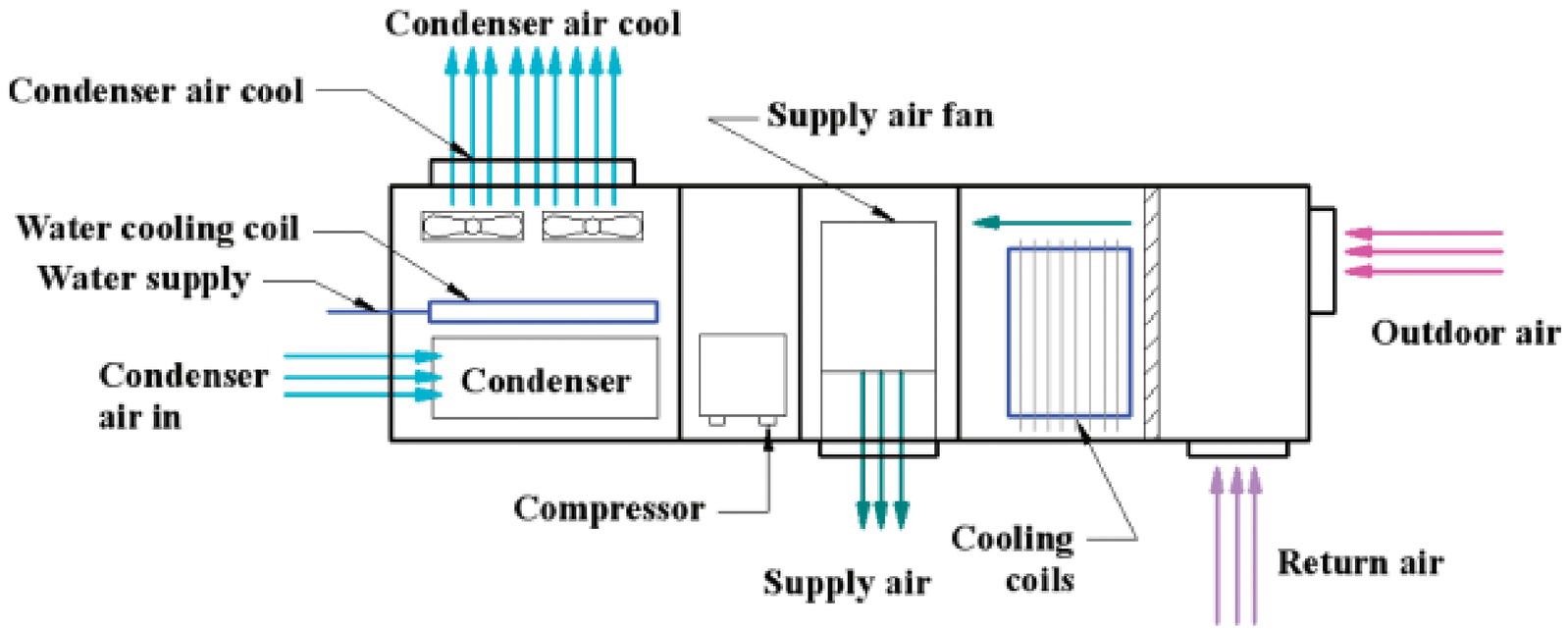
- **Sensor**: Airflow sensors measure the flow of air within the HVAC system.
- **Setpoint**: Desired airflow rates are set based on building requirements.
- **Controller**: A controller adjusts the speed of fans or dampers to maintain the specified airflow.
- **Actuator**: The controller activates fans or dampers to increase or decrease airflow as needed.
- **Feedback**: The sensors provide feedback to the controller to ensure the system maintains the correct airflow.

CO2 Control Loop (for indoor air quality)

- **Sensor**: CO2 sensors monitor indoor carbon dioxide levels, which can affect indoor air quality.
- **Setpoint**: Desired CO2 concentration levels are established.
- **Controller**: The controller adjusts ventilation rates (e.g., by controlling dampers) to maintain CO2 levels within the specified range.
- **Actuator**: Dampers and fans are used to control ventilation rates.
- **Feedback**: CO2 sensors provide feedback to the controller for precise control.

Assessment

1. Can you say this shown in fig. is the example of which method of HVAC?



References

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2. Reinhold A, Carlson Robert A, Di Giandomenico, “Understanding Building Automation Systems: Direct Digital Control, Energy Management, Life Safety, Security Access Control, Lightning, Building”, R. S Means company limited, 1st edition, 1991.

Thank You