System Thinking - Ogata

Modern Control Systems - Ogata

- Main purpose : To analyse systems that control "something". The "something" can be position, velocity, temperature, pressure, etc.

→ **Definitions** :

- **Controlled Variable** : The quantity or condition that is measured and controlled.

- **Manipulated Variable** : The quantity or condition that is varied by the controller, to affect the controlled variable.

Manipulated Variable ⟶ i/p
Controlled Variable ⟶ o/p

- **Plants** : A physical object / device to be controlled.

- **Processes** : An operation to be controlled.

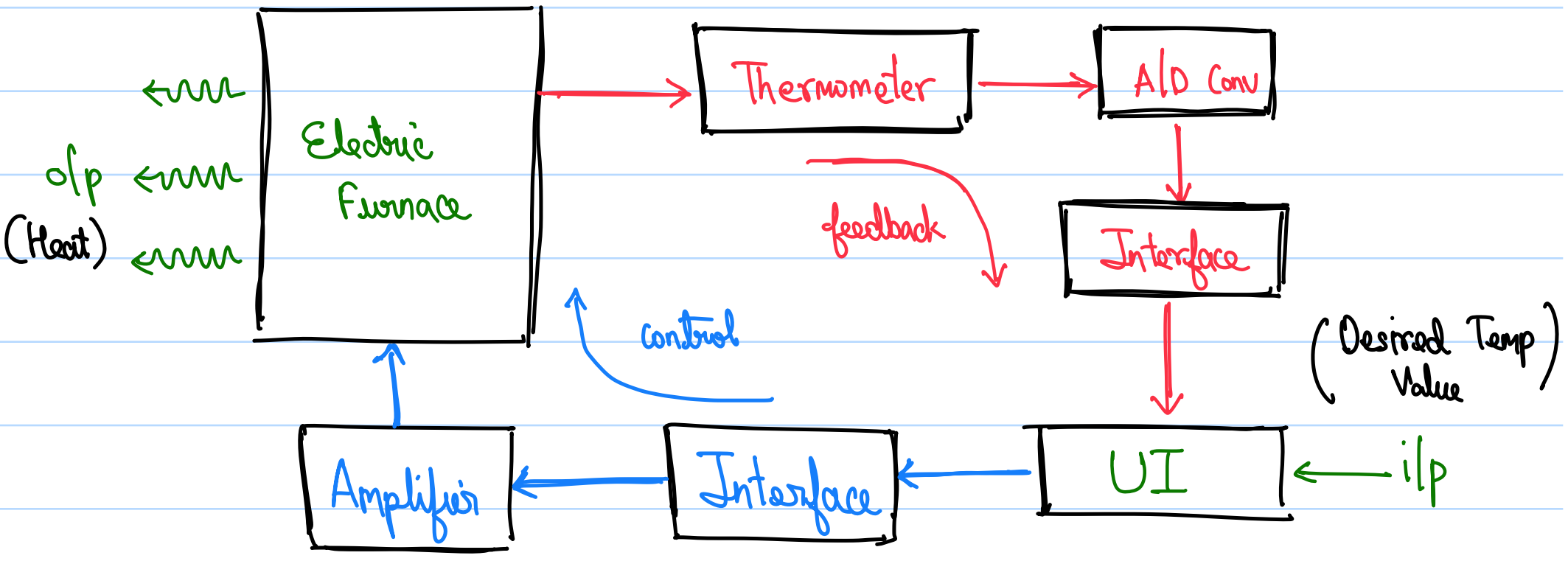
- **System** : A combination of components that perform a certain objective.

- **Disturbance** : A signal / factor that adversely affects the value of the controlled variable. Can be internal or external to the system.

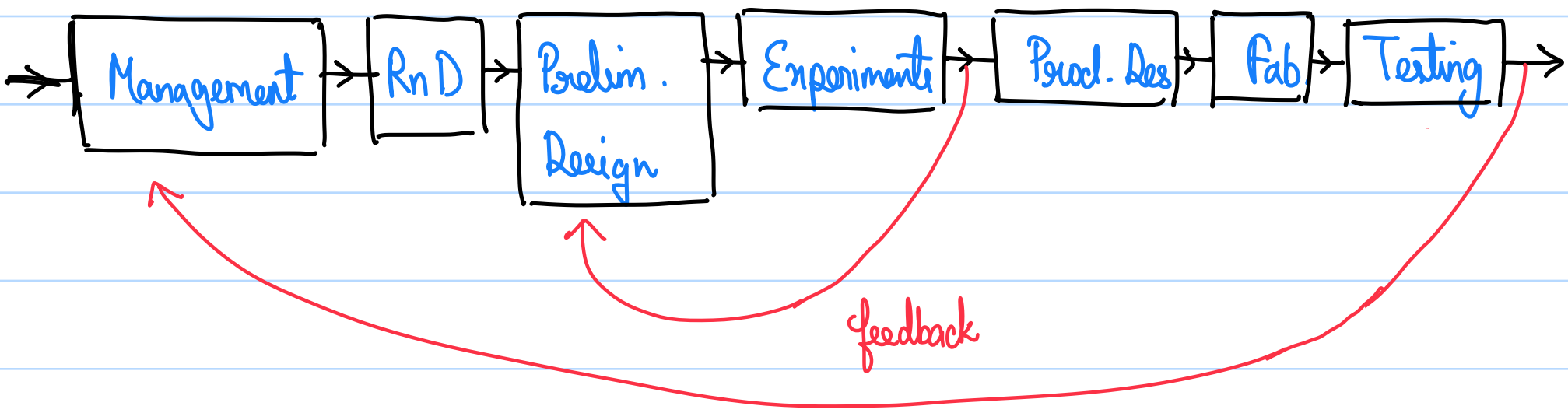
- **Feedback Control** : A system that reduces the difference between the output and a reference input, using that difference. Used to remove known disturbances to a system.

→ **Examples of Control Systems** :-

1) **Thermostat** :-



2) **Business Workflow** :-



→ Closed Loop and Open Loop Control :-

- **Feedback Control Systems :-**

A system that maintains a prescribed relation-ship between the o/p and i/p by comparing them and using the difference as a means of control.

- **Closed Loop Control Syetems :-**

The actuating error signal (difference between i/p and feedback (the o/p signal or a function of o/p)) is fed into the controller to reduce the error.

- All Closed loop systems use a feedback control action.

- **Open Loop Control Systems :-**

Systems in which the output has no effect on the actin of the controller, ie, has a fixed operating condition.

- The accuracy of an open loop system depends on the calibration of its components.

- The presence of any disturbance will adversely affect the output of the system.

- Any system that operates on a time basis is open-loop. ex: Traffic

signals, Washing machines.

- Comparision:

Open loop Control Systems	Closed Loop Control Systems
- Easier to build	- Relatively insensitive to disturbances and errors.
- Lower Cost	- Stability is a Major problem (overcorrections may result in oscillations)
- Preferred when only known disturbances exist	- Higher Cost
- Vulnerable to unknown disturbances.	

✱ Laplace Transform :-