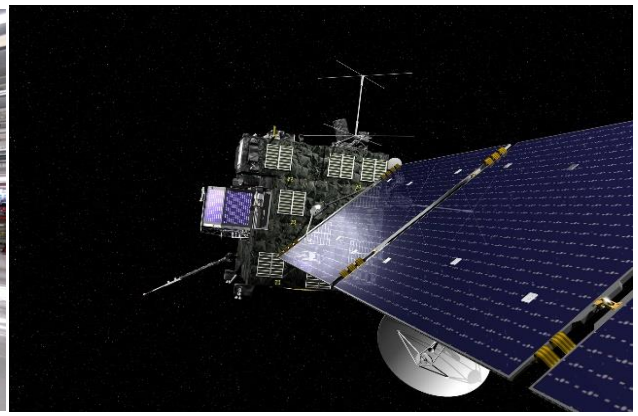
EE 380
Control Engineering I

January 12, 2025

Dr. Ali AlBeladi

Control is all around us!



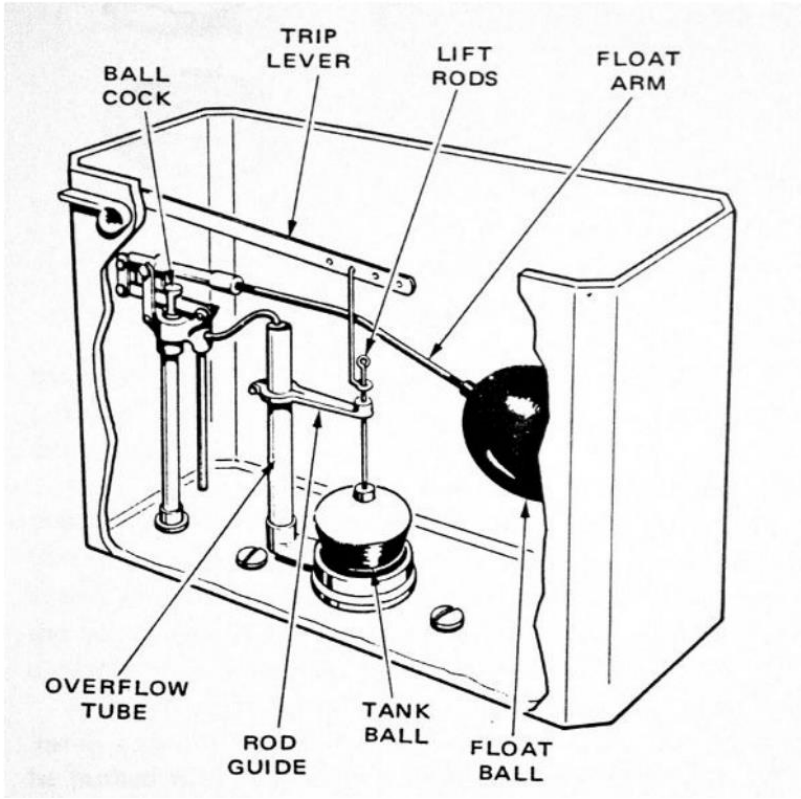
Control is all around us: Thermostat

Honeywell T-86 "Round" Thermostat (1953)

Nest 2nd Gen Learning Thermostat (2014)

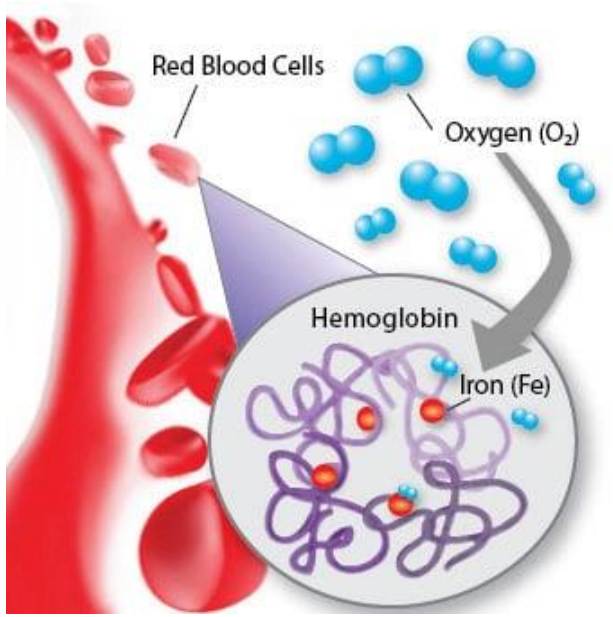
The thermostat maintains desired (reference) temperature despite disturbances (such as doors opening/closing, variations of outside temperature, number of persons in the house, etc.)

Control is all around us: Toilet Tank

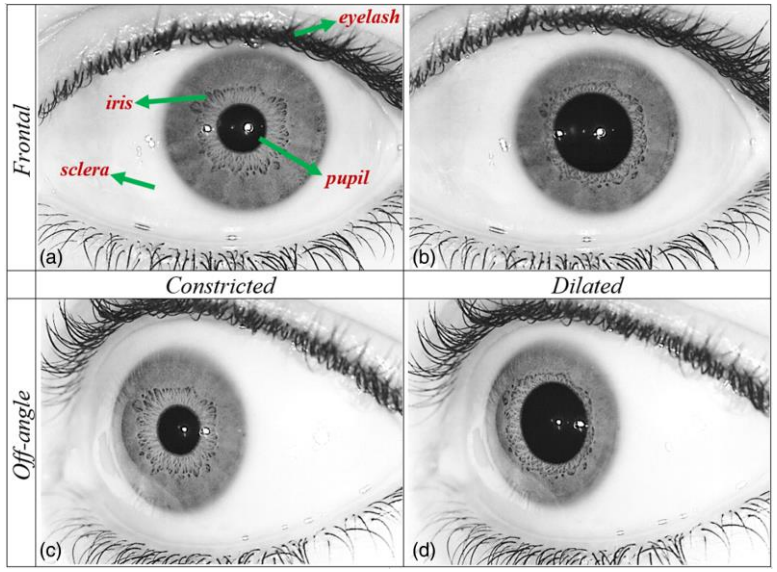


The flush toilet employs a control mechanism that ensures that the toilet gets flushed and that the tank is filled to a set reference level. Similar systems are used in other applications where fluid levels need to be regulated.

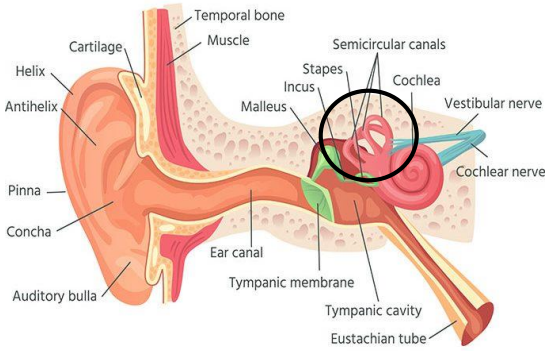
Control Systems in our body



Oxygen level in the body

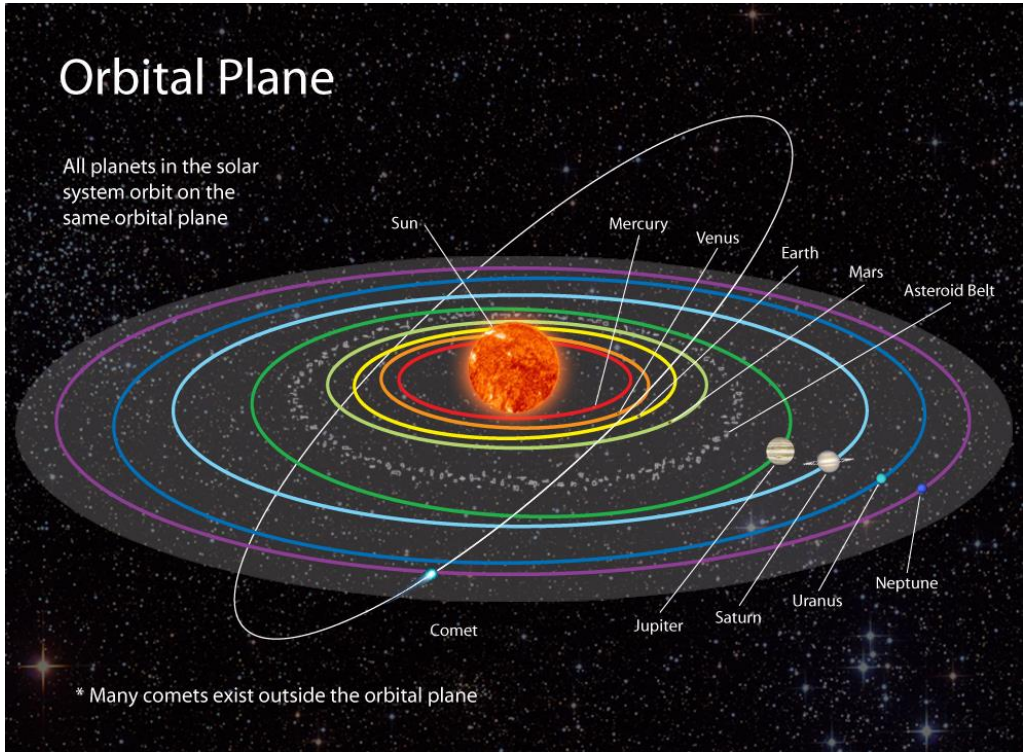


Pupil size variation



Balancing

Astronomy


Orbital Plane
All planets in the solar system orbit on the same orbital plane
Sun
Mercury
Venus
Earth
Mars
Asteroid Belt
Comet
Jupiter
Saturn
Uranus
Neptune
* Many comets exist outside the orbital plane

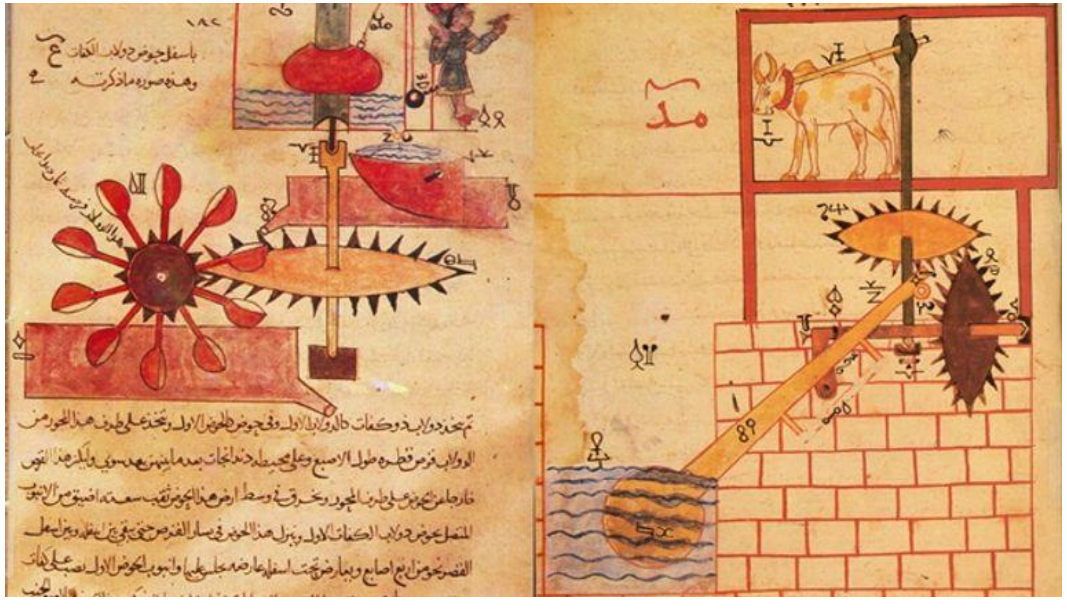
Some History

Banu Mosa (9th century)

"كتاب الحيل" إخوة بني موسى بن شاكر

Al-Jazari (1206)

"الجامع بين العلم والعمل النافع في صناعة الحيل" الجزري



"It is impossible to over-emphasize the importance of Al-Jazari`s work in the history of engineering. Until modern times, there is no other document from any cultural area that provides a comparable wealth of instructions for the design, manufacture and assembly of machines…

The impact of these inventions can be seen in the later designing of steam engines and internal combustion engines, paving the way for automatic control and other modern machinery.", Donald Hill

Some History

James Watt (1788)

Invented the Centrifugal Governor for controlling the speed of the steam engine.

The original governor kept the engine running at (more or less) constant speed via what is known today as proportional control. Many improvements were added to the original design.

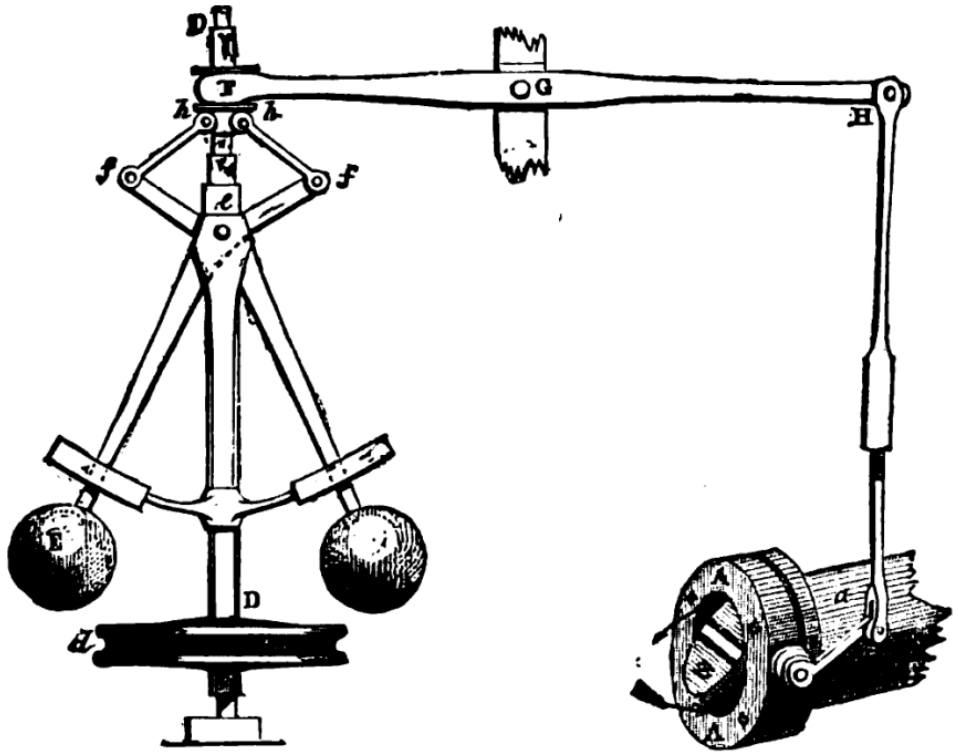


FIG. 4.—*Governor and Throttle-Valve.*

Course Roadmap

Modeling of electric, mechanical and electromechanical systems, using:

- Differential equations,
- Transfer functions,
- Block diagrams,
- State variables

(35%)

Analysis of properties of control systems, such as:

- Stability,
- Controllability,
- Tracking, in time and frequency domains

(50%)

Design of feedback controllers, to meet desired system performance specifications such as:

- PID,
- Lead and lag Compensators, Pole placement designs

(15%)