Automatic control

Minimum human intervention is required to control many large facilities such as this electrical generating station.

Automatic control is the application of control theory for regulation of processes without direct human intervention. In the simplest type of an automatic control loop, a controller compares a measured value of a process with a desired set value, and processes the resulting error signal to change some input to the process, in such a way that the process stays at its set point despite disturbances. This closed-loop control is an application of negative feedback to a system. The mathematical basis of control theory was begun in the 18th century, and advanced rapidly in the 20th.

Designing a system with features of automatic control generally requires the feeding of electrical or mechanical energy to enhance the dynamic features of an otherwise sluggish or variant, even errant system. The control is applied by regulating the energy feed.

1 Examples

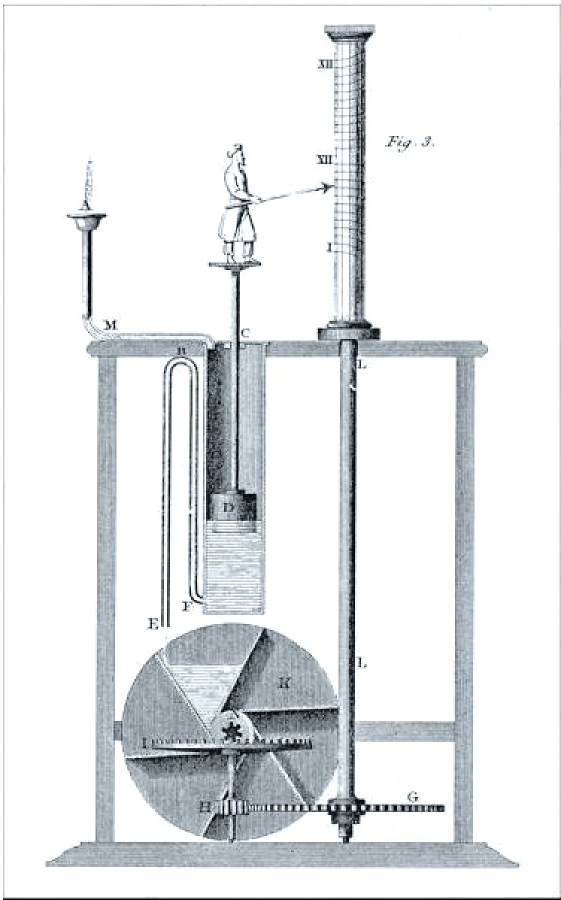
Automatic control can self-regulate a technical plant (such as a machine or an industrial process) operating condition or parameters by the controller with minimal human intervention. A regulator such as a thermostat is an example of a device studied in automatic control. Another possible example of Automatic Control are the ABS of a car.

2 Functions

- Control
- Sensing
- Metrics
- Measurement
- Comparison
- Computation
- Correction

3 History of automatic Control

3.1 Ancient Greece



Ctesibius's clepsydra (3rd century BC).

It was a preoccupation of the Greeks and Arabs (in the period between about 300 BC and about 1200 AD) to keep accurate track of time. In about 270 BC the Greek

Ctesibius invented a float regulator for a water clock, a device not unlike the ball and cock in a modern flush toilet. The invention of the mechanical clock in the 14th century made the water clock and its feedback control system obsolete. The float regulator does not appear again until its use in the Industrial Revolution.

3.2 Industrial Revolution in Europe

Thomas Newcomen invented the steam engine in 1713, and this date marks the accepted beginning of the Industrial Revolution; however, its roots can be traced back into the 17th century. The introduction of prime movers, or self-driven machines advanced grain mills, furnaces, boilers, and the steam engine created a new requirement for automatic control systems including temperature regulators (invented in 1624 (see Cornelius Drebbel)), pressure regulators (1681), float regulators (1700) and speed control devices. The design of feedback control systems up through the Industrial Revolution was by trial-and-error, together with a great deal of engineering intuition. Thus, it was more of an art than a science. In the mid-19th century mathematics was first used to analyze the stability of feedback control systems. Since mathematics is the formal language of automatic control theory, we could call the period before this time the prehistory of control theory.

3.3 First and Second World Wars

The First and Second World Wars saw major advancements in the field of mass communication and signal processing. Other key advances in automatic controls include differential equations, stability theory and system theory (1938), frequency domain analysis (1940), ship control (1950), and stochastic analysis (1941).

3.4 Space/computer age

With the advent of the space age in 1957, controls design, particularly in the United States, turned away from the frequency-domain techniques of classical control theory and backed into the differential equation techniques of the late 19th century, which were couched in the time domain. The modern era saw time-domain design for nonlinear systems (1961), navigation (1960), optimal control and estimation theory (1962), nonlinear control theory (1969), digital control and filtering theory (1974), and the personal computer (1983).

4 See also

- Control theory
- Process control
- Controller (control theory)
- Control engineering
- PID loop
- VisSim
- EICASLAB
- Feedback
- Feedforward Control

5 Further reading

- V. Gurevich “Electronic Devices on Discrete Components for Industrial and Power Engineering”, CRC Press, New York, 2008, 418 p.
- Tang Bingxin “Fundamentals of Control Engineering”, 37 p.
- http://www.tpub.com/content/doe/h1013v2/css/h1013v2_112.htm

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