

## Control Valves

Automatic control systems were first developed more than two thousand years ago. The ancient water clock of Ktesibios in Alexandria Egypt dating to the third century B.C. is thought to be the very first feedback control machine on record. This clock kept time by means of regulating the water level in a vessel and the water flow from the vessel. A popular style, this successful tool was being made in the same manner in Baghdad when the Mongols captured the city in 1258 A.D.

Different automatic equipment through history, have been utilized to complete particular tasks. A common desing utilized through the seventeenth and eighteenth centuries in Europe, was the automata. This particular machine was an example of "open-loop" control, comprising dancing figures which would repeat the same task again and again.

Closed loop or also called feedback controlled machines consist of the temperature regulator common on furnaces. This was developed in 1620 and attributed to Drebbel. Another example is the centrifugal fly ball governor developed in the year 1788 by James Watt and used for regulating steam engine speed.

The Maxwell electromagnetic field equations, discovered by J.C. Maxwell wrote a paper in 1868 "On Governors," which was able to describing the exhibited by the fly ball governor. To be able to describe the control system, he used differential equations. This paper exhibited the usefulness and importance of mathematical methods and models in relation to understanding complicated phenomena. It even signaled the start of mathematical control and systems theory. Previous elements of control theory had appeared before by not as convincingly and as dramatically as in Maxwell's analysis.

New control theories and new developments in mathematical techniques made it possible to more precisely control more dynamic systems than the original model fly ball governor. These updated methods include different developments in optimal control during the 1950s and 1960s, followed by development in stochastic, robust, optimal and adaptive control methods in the 1970s and the 1980s.

New applications and technology of control methodology have helped produce cleaner auto engines, more efficient and cleaner chemical processes and have helped make space travel and communication satellites possible.

Originally, control engineering was carried out as just a part of mechanical engineering. Control theories were at first studied with electrical engineering since electrical circuits can simply be explained with control theory techniques. Currently, control engineering has emerged as a unique discipline.

The first control relationships had a current output which was represented with a voltage control input. As the correct technology to implement electrical control systems was unavailable at that moment, designers left with the option of slow responding mechanical systems and less efficient systems. The governor is a very effective mechanical controller which is still normally used by several hydro factories. Eventually, process control systems became offered prior to modern power electronics. These process controls systems were often utilized in industrial applications and were devised by mechanical engineers making use of pneumatic and hydraulic control machines, a lot of which are still being utilized nowadays.