

# An Introduction To Fuzzy Control Systems

\* This document is an introduction to fuzzy control systems. It provides an overview of their theory of operation, followed by elementary examples of their use.

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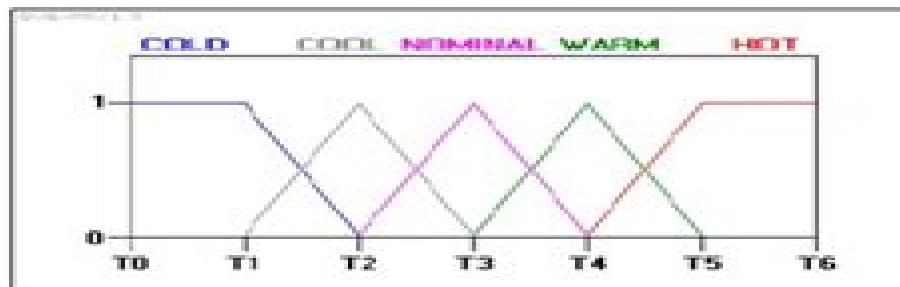
## [1] INTRODUCTION TO FUZZY LOGIC & FUZZY CONTROL

\* "Fuzzy logic" has become a common buzzword in machine control. However, the term itself inspires a certain skepticism, sounding equivalent to "half-baked logic" or "bogus logic". Some other nomenclature might have been preferable, but it's too late now, and fuzzy logic is actually very straightforward. Fuzzy logic is a way of interfacing inherently analog processes, that move through a continuous range of values, to a digital computer, that likes to see things as well-defined discrete numeric values.

For example, consider an antilock braking system, directed by a microcontroller chip. The microcontroller has to make decisions based on brake temperature, speed, and other variables in the system.

The variable "temperature" in this system can be divided into a range of "states", such as: "cold", "cool", "moderate", "warm", "hot", "very hot". Defining the bounds of these states is a bit tricky. An arbitrary threshold might be set to divide "warm" from "hot", but this would result in a discontinuous change when the input value passed over that threshold.

The way around this is to make the states "fuzzy", that is, allow them to change gradually from one state to the next. You could define the input temperature states using "membership functions" such as the following:



With this scheme, the input variable's state no longer jumps abruptly from one state to the next. Instead, as the temperature changes, it loses value in one membership function while gaining value in the next. At any one time, the "truth value" of the brake temperature will almost always be in some degree part of two membership functions: 0.6 nominal and 0.4 warm, or 0.7 nominal and 0.3 cool, and so on.

# An Introduction To Fuzzy Control

**Brendan G. Carr**



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