

FUZZY LOGIC CONTROL SYSTEM AND ITS APPLICATION AREA IN DAILY LIFE

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Abstract: The concept of Fuzzy logic and Fuzzy set are based on the human thinking and natural activities. It presents predicates which are already present in nature. This works describe the working of Fuzzy logic control system in a technical environment. Generally a fuzzy set is a superset of Boolean logic that has been extended to handle the concept of partial truth: Truth values lies between “completely true” and “completely false”.

Fuzzy system can be easily implemented in Technical (hardware, software or both). It can be built anything any small handy utility system.

Fuzzy logic in the narrow sense is symbolic logic with a comparative notion of truth developed fully in the spirit of classical logic (syntax, semantic, axiomatization, truth preserving deduction, completeness etc. both propositional and predicate logic.

Fuzzy sets are set whose elements have degree of membership. Fuzzy sets theory permits the gradual assessment of the membership of element in set.

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1.0 Introduction: Every human have an extraordinary (remarkable) capability to reason and make decision in an environment of uncertainty, incompleteness of information and partiality of knowledge, truth and class membership. Following statements describe the objective of *Fuzzy Logic*:

- The Weather is cloudy and mostly cloudy
- The water is warm
- The boy is very tall
- The Seminar starts around 9 am.

The term *fuzzy logic* emerged in the development of the theory of *fuzzy sets* by *Lotfi Zadeh (1965)*. A type of logic that recognizes more than simple true and false values.

For example the statement, “Today is sunny” might be –

- 100% true if there are no clouds,
- 80% true, if there are a few clouds,
- 50% true, if it’s hazy and
- 0% true if it rains all days.

Fuzzy logic has proved to be particularly useful in expert system and other artificial intelligence applications. It is also used in some spell checkers to suggest a list of probable words to replace a misspelled one.

In fuzzy process control, the expertise of a skilled operator may be encapsulated into a system in terms of linguistic descriptions of knowledge about human operating criteria, and knowledge about the process states and input & output relationships. An ever increasingly number of contributions is appearing in the technical literatures, which are focused on applications of fuzzy control techniques to monitoring and control of unmanned machining systems

1.1 Basic Principles of Fuzzy Systems: The aim of *fuzzy logic* based system is to imitate human conduct (behavior) in managing and solving problems that can not entirely be formalized by use of mathematical models and treated by use of system theory approaches. In *fuzzy process*

control, expertise is encapsulated into a system in terms of linguistic description of knowledge about human operating criteria, and knowledge about the process state and input output relationship. The control actions are generally encoded by means of fuzzy logic inference rules.

1.2 Fuzzy Inference Rules: The process of Fuzzy Inference comprises the following five rules:

1. Fuzzification of the input variables
2. Application of the fuzzy operators (AND or OR) in the antecedent
3. Implication from the antecedent to the consequent
4. Aggregation to the consequent across the rules
5. Defuzzification.

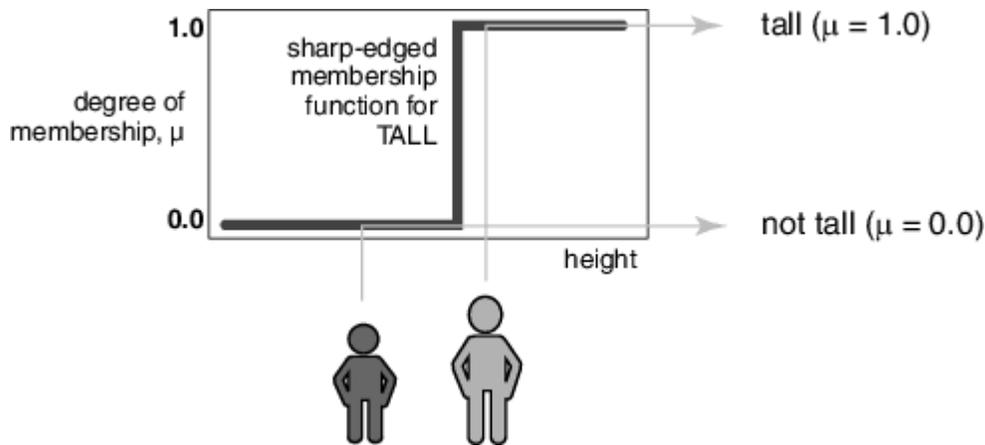
1.3 Approaches of Fuzzy Based Control System: There are two different approaches in international research and control system:

1.3.1 Algorithm Optimization Approach: Stem from mathematics, classical computer science and operation research can find and the global optimum with respect to the goal functions chosen.

1.3.2 Heuristic Approach: Use to try to find good solutions fast by employing AI methods and expert knowledge.

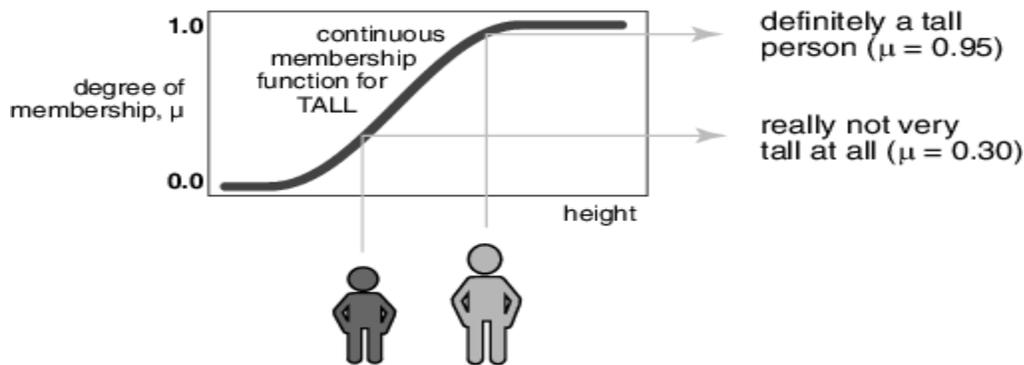
These approaches are not necessarily mutually exclusive but can be combined in a useful manner.

1.4 Fuzzy Sets: In mathematics a set, by definition, is a collection of things that belong to some definition. Any item either belongs to that set or does not belong to that set. Let us look at another example; the set of tall men. We shall say that people taller than or equal to 6 feet are tall. This set can be represented graphically as follows:



The function shown above describes the membership of the 'tall' set, you are either in it or you are not in it. This sharp edged membership functions works nicely for binary operations and mathematics, but it does not work as nicely in describing the real world. The membership function makes no distinction between somebody who is 6'1" and someone who is 7'1", they are both simply tall. Clearly there is a significant difference between the two heights. The other side of this lack of distinction is the difference between a 5'11" and 6' man. This is only a difference of one inch, however this membership function just says one is tall and the other is not tall.

The fuzzy set approach to the set of tall men provides a much better representation of the tallness of a person. The set, shown below, is defined by a continuously inclining function.



The membership function defines the fuzzy set for the possible values underneath of it on the horizontal axis. The vertical axis, on a scale of 0 to 1, provides the membership value of the height in the fuzzy set. So for the two people shown above the first person has a membership of 0.3 and so is not very tall. The second person has a membership of 0.95 and so he is definitely tall. He does not, however, belong to the set of tall men in the way that bivalent sets work; he has a high degree of membership in the fuzzy set of tall men.

1.5 Applications of Fuzzy Logic:

Automobile and other vehicle subsystems, such as automatic transmissions, ABS and cruise control (e.g. Tokyo monorail)

Air conditioners

The Massive engine used in the *Lord of the Rings* films, which helped show huge scale armies create random, yet orderly movements

Cameras, Digital, such as edge detection, Rice cookers ,Dishwashers, Elevators

Washing machines and other home appliances

Video game artificial intelligence

Language filters on message boards and chat rooms for filtering out offensive text

Pattern recognition in Remote Sensing

Fuzzy logic has also been incorporated into some microcontrollers and microprocessors, for instance, the free scale 68HC12.

1.6 Conclusion: We have spent more time to study the *Fuzzy Set and logic* and the application areas of them. In this paper we use the Fuzzy inference rules and two different approaches of Fuzzy logic to describe the use and application of *Fuzzy logic*. In this paper we have shown the sets of fuzzy logic in terms of mathematics and different applications of it.

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