Fuzzy Set Theory

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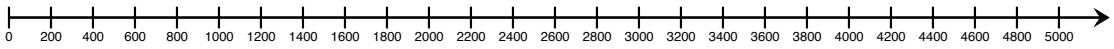
1 Introduction

Motivating Examples

A. If my running shoes are worn out and I have enough money in my monthly budget, then I will buy myself a new pair.

- _____: *Worn out running shoes* – Which shoes are worn out?
- _____: *Enough money* – How much money (Kč) is enough?



- _____: *and*

  Human decision making takes into account the _____ of the condition of the shoes and the condition of the budget.

- _____: *buy vs. not buy*
- _____: *if ... then*

  Did I tell the truth or not?

B. If pressure is high in the input tank and even higher in the output tank, then energy supply is low and I must make a moderate reduction in power to non-critical processes.

- What are the fuzzy sets?
- What other fuzzy objects are present?

Applications of Fuzzy Set Theory

A. The most widely used application is _____.

- Many automated processes still require the oversight of expert human operators, eg.:

- Human operators are responsible for:

B. The two levels of fuzzy control systems

Expert human knowledge	Implementation
List of action / reaction rules: • *If the situation is such and such, then I should do the following...* • ...	Math model + Computer program: • Choice of membership functions for fuzzy sets • Fuzzy implementations of logical operators, relations, etc. • Algorithm to run the whole process

C. Benefits of fuzzy control

- Higher degree of _____
  - Lower costs (?)
  - Greater consistency
- _____ of areas of expertise
  - Industrial field experts (machine operators and process engineers)
  - Mathematical / computer experts (programmers who know fuzzy set theory)
  - Better _____ and _____
  - Reduced _____ and maintenance time
- _____ and novelty of fuzzy set theory
  - research grants
  - patents
  - marketing

The Nature of Fuzzy Set Theory

A. Fuzzy math is _____.
There are many competing definitions for each concept.

B. Fuzzy math is _____.
Choosing the "best" definition is not a question of _____,
but of getting the _____ in your particular application.

C. Fuzzy math is _____.
Lofti A. Zadeh. "Fuzzy Sets." *Information and Control* **8** (1965), 338–353.

D. Fuzzy math is _____.
Zadeh died in September, 2017 with about _____ citations, of which _____
were for his original 1965 paper, "Fuzzy sets."