

Multiple Input Multiple Output

Sometimes we ask ourselves whether we can control a system which has multi-variables, Today we are going to talk about this issue.

First we have to understand what is MIMO, MIMO is as shown in the title that we have a system with many variable affect it, So We could get that it can't be a linear relation between the input and output because of many factors in the system.

From this concept you could get that the dealing with this system is going to be more complex than the single input single output (SISO) system, So why we have to use this system ? The answer for this question also in this concept, Let's say we want to control a robot motion (i.e. driverless car), It won't move in just a direction, So we have three variables (X,Y, θ) for every wheel and we have a destination in also multi variables, So we have a MIMO system right now.

So, what's the difference between MIMO and SISO systems ?

- it's clear that dealing with MIMO is definitely more harder than dealing with SISO system.
- MIMO control system could be built from sub SISOs.
- Tuning is an effective way to deal with SISO system but it couldn't be done very easily in MIMO.
- MIMO could deal with more complex systems that depends on many factors.

As was mentioned that MIMO control system could be built by other SISO controllers, So we could use the proportional-integral-differential (PID) controller as MIMO controller although the dealing will be more harder. Also we could use the fuzzy controller.

So, what is the fuzzy controller ?

The fuzzy control system is a system that depends on the input and the output and the rate of change of them.

Why to use it ?

It's someway easy to control because it depends on if-else rules, also it uses human experience for designing a controller.

The contents of the fuzzy control system is :

- 1- Fuzzifier : Converts the input variables in numerical forms to linguistic variables.
- 2- Controller : performs the fuzzy logic operation of assigning the outputs based on the linguistic information. It performs approximate reasoning based on the human way of interpretation to achieve control logic.
- 3- Defuzzifier : converts this fuzzy output to the required output to control the system.

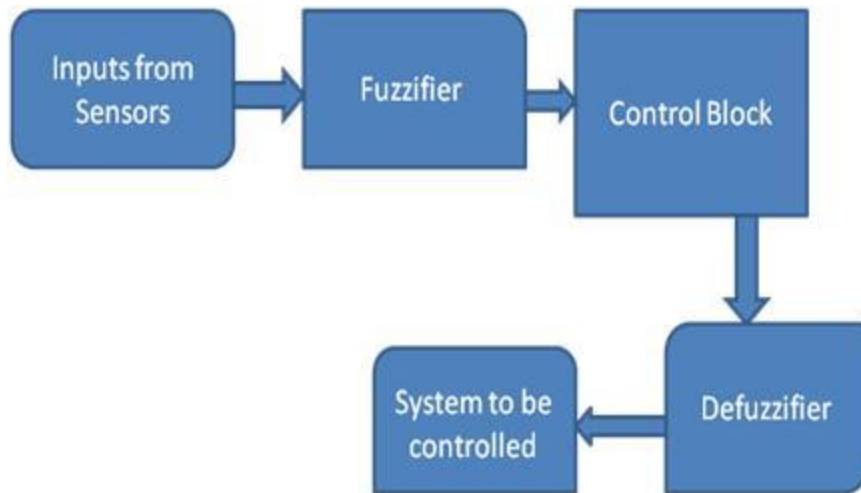


Fig1. Fuzzy control system

Advantages:

Cheaper than others, Robust, Customizable, Emulate human deductive thinking, Reliable and efficient.

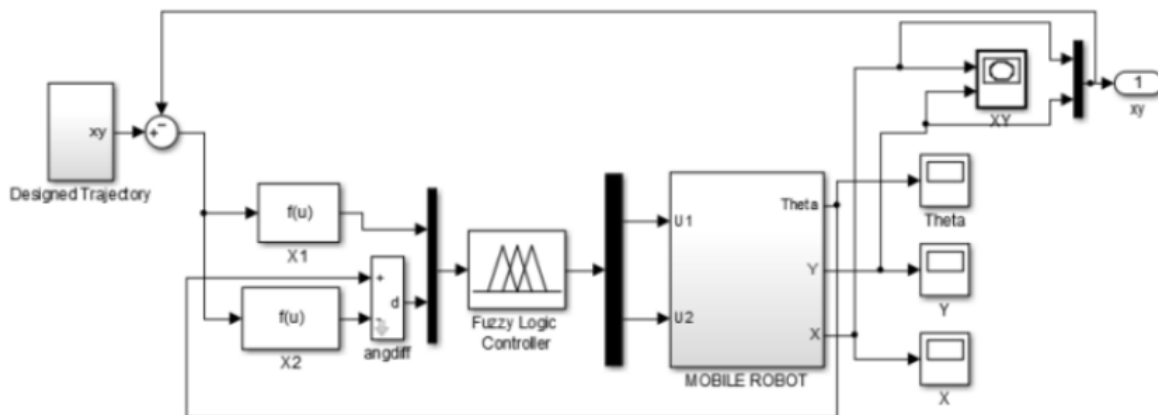


Fig2. MIMO fuzzy controller for mobile robot tracking trajectory

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