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Accident Control Using Fuzzy Logic: Survey

Swacheta Dutta, Tasher Ali Sheikh, Smriti Baruah, Pooja Sharma and Sahadev Roy

Department of Electronics and Communication Engineering,
National Institute of Technology, Arunachal Pradesh, India
swacheta.duttaece16@gmail.com

ABSTRACT

Many automobile accidents could be control if the exact amount of distance, speed, force can maintain and calculated at the appropriate time. In this paper, discuss different algorithm and shear-force for accident avoidance in emergency time. The fuzzy controller algorithm reduces the system error approximate to zero, So that the driver need not to identify the system model, only they have to maintain the operating range of the actuator to define the membership function and to minimize the control action and provided robustness to the control system and allowing the commercial application through user interference. Which means that accident can be minimize up to 100% using these algorithm. Collision can avoid by using those algorithms to tune the fuzzy parameters. The PID methods is highly intended and produces zero overshoot with enhance transient response.

Key words: Collision, tuning fork, GU, GIE, GCE, PID, ISE, ACSS, SNOM, shear-force

INTRODUCTION

Vehicular traveling is increasing day by day throughout the world, particularly in large urban areas. Current research shows that in many countries, motor vehicle accidents first position among all fatal accidents [1]. By the increasing use of automobiles in cities, accidents are gradually increases now a day. Therefore, it emerging topic of research now a day for optimizing accident controls methods for better accommodating the increasing demand. Therefore, the transportation system will continue to grow, and intelligent accident controls have to employ to face the road congestion's problems [2]. By application of fuzzy logic it is possible to overcome problems like's congestion, collision and traffic problems. Driver going behind the other vehicle has to keep such a safety distance that he could avoid the accident in case the other driver in front of him suddenly slowdowns. By realizing of measured distance between the vehicles collision can be minimize by the depending of their speed.

Here is the example of the principal of one of the solution to measure distances and speeds for a long time. The measurement can realized by means of retro-reflective sensors. For a retro-reflective application, the transmitter and receiver are placed into the same device. A reflector is placed over opposite to the sensor and transmitted light returns back to the receiver. Retro-reflective sensors are used for medium range (i.e. up to 16m) or average excess gain applications. The effective beam describes the area in order to reliably sense a target and it increases as the distance between the sensor and reflector increases. When the target is in front of the reflector, it must be at least as large as the reflector. Smaller objects can detect if they are close to the sensor and they are large as the optics. So It won´t be collide within them [3].

SOME ACCIDENT CONTROL ALGORITHMS

Control Optimization Algorithm

Allowing a system to have a better resolution and a faster response, control algorithm is applied to optimized vehicle accident. This upgrade measures the error between the reference point and the current position and converges to zero faster by showing accurate information about the topography of the sample surface. Fig. 1 show the membership functions of both inputs and the output of the fuzzy logic control are tri-angular in the middle. The functions on the sides are linear which saturations after reaching point 1. For better control resolution the area of membership, functions are narrower whose regions are near zero error. On the other hand, for faster control response the area of membership function is made wider, which are far from zero error regions [4]. In order to improve resolution, there are no singletons. All the functions are continuous and there are 3 membership functions for every input and output, which are negative (N), zero (Z) and positive (P) that are shown in table 1[5].

Table -1 Rules of Fuzzy Logic

e / Δe	N	Z	P
N	P	P	N
Z	P	Z	N
P	P	N	N

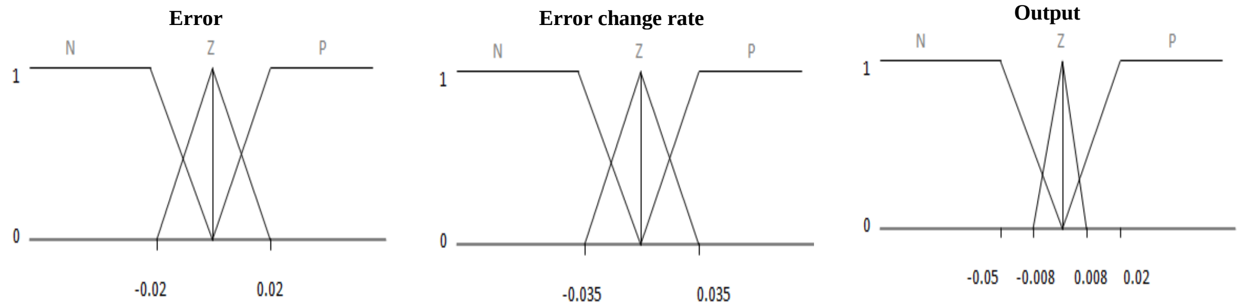


Fig. 1 Fuzzy logic membership function

The input of the system has been processed by the Fuzzy Logic algorithm and calculates the output, which is called u. In order to reduce e (error), u is the amount of voltage it has to be added to the current voltage (DAQ output). By the addition of these small values to the system which makes it easy to get the desire value or position. For control action, it is necessary to choose the correct values because high values can make the system and process unstable, low values can make it slow. Parameters have to be very accurate values so that we can get controlled task. Changing of large voltage is required to move the system fast but not too large to produce oscillations that will make the system unstable and will take more time to stabilized [6].

Auto-Tune Algorithm

Fig. 2 shows the frequency sweep of tuning fork. The main purpose of the Auto-Tune Algorithm is to increase system efficiency so that time can be saved when it is tuned at its maximum resonance frequency. It is difficult to find and localize the optimal point with the bare eye. For getting more accurate measures, tuning is excited to its maximum sensibility. Manual tunes take approximately 1 or 2 minutes based on the experience of the operator. With the proposed algorithm, the tuning operation takes approximately 10 second to enable the system work at its greater sensing potential, which reduces large amount of time than the manual control as describe earlier. The auto-tune algorithm has the following steps:

- Frequency sweep: Frequencies before maximum (-500Hz) and after (+500Hz) is expected which is covered by a sweep,
- Recording data: Data is saved corresponding to the amplitude and the frequency of the whole sweep,
- Assign the frequency: Take the value of frequency where the amplitude is greater than the others do when the sweep finish.

For this procedure, a computer compatible function generator is need so it can program with the aid of Lab VIEW or any other software [6].

An auto-tune algorithm for a fuzzy PID controller has been designed and applied to several second order systems. This algorithm is highly effective and can achieve zero overshoot with faster rise time and shorter settling time by producing a faster transient response. The details of the algorithm can summarize as follows. First, a closed-loop test is performed by applying the fuzzy PD+I controller on the system. The controller gains are set to their default values (one) [7]. The output is enclosed so that the overshoot is not allowed to exceed 100%, where the system becomes unstable. Secondly, if the response exhibits an overshoot with amplitude higher than 1%, the overshoot is measured. The values of the output gain (GU) and gain of the integral of error (GIE) are calculated as follows:

$$GU = Mp \tag{1}$$

$$GIE = 1 / (2 * Mp) \tag{2}$$

Where Mp is the maximum percentage overshoot. This significantly reduces the overshoot. The gains are kept unchanged when the overshoot is less than 1%. Then, to improve the rise-time, the value of gain of challenges error (GCE) is decreased and if the system performance is not satisfactory, the value of GIE is increased. The last two steps are performed in an iterative base and the integrated square error (ISE) and the maximum percentage overshoot (Mp) were chosen to measure the performance of the controller [7].

Adaptive Charged System Search (ACSS) Algorithm

This algorithm is for optimal tuning of Takagi-Sugeno Proportional-Integral Fuzzy Controllers (T-S PI-FCs) .The five stages of this algorithm are engagement, exploration, explanation, elaboration and evaluation, which involve the adaptation of the acceleration, velocity, separation distance parameters to the iteration index, substitution of the worst charged particles' fitness function values and positions with the best particles data. The ACSS algorithm solves the optimization problems aiming to minimize the objective functions express as the sum of absolute control error plus squared output sensitivity function, resulting in optimal fuzzy control systems with reduced parametric sensitivity. The search ability of this algorithm based on the interactions between charged particles (CPs) that are moving through a predefined domain. CPs is also referred to as agents. Due to the good balance between exploration and exploitation offered by the ACSS algorithms, they can conveniently be used to solve discrete and continuous optimization problems with non-convex objective functions, which eventually have several local minima. The ACSS-based tuning of T-S PI-FCs is applied to second-order servo systems with an integral component. The ACSS algorithm is validated by an experimental case study dealing with the optima tuning of a T-S PI-FC for the position control of non-linear servo system [3].

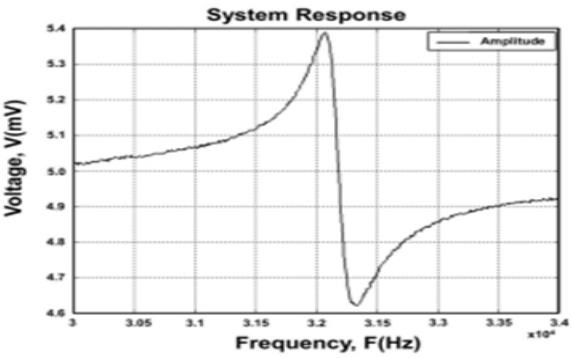
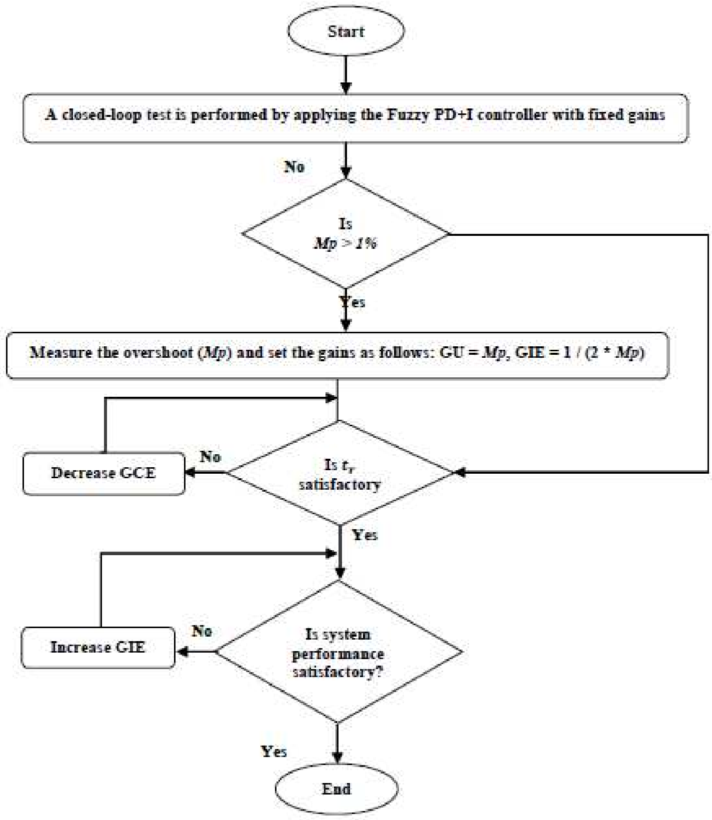


Fig. 2 Frequency sweep of tuning fork plot



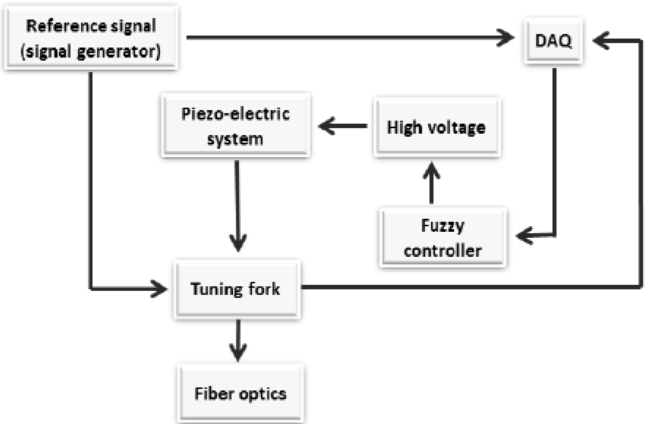


Fig. 4 Schematic block diagram of shear force control system

Fig. 3 The flowchart of the auto-tune algorithm

SHEAR-FORCE LOCATION

Controlling the tip-sample distance in a scanning near field optical microscope (SNOM) using fuzzy control is needed. The fuzzy controller design assumes only one input signal defined as the difference of the sampled signal (tuning fork-tip) and the reference signal, which are compared through designed software. This signal is used as the rule-base of the fuzzy logic controller. A basic data acquisition is used as interface to manipulate the fuzzy controller as feedback scheme in the positioning system for shear force control [8]. In SNOM, control tip-sample, the manipulation system based on the use of piezoelectric bimorph and due to the nonlinearity characteristics of these actuators [9]. The tip to a shear force section is to be conducted by two different approaches have to be done:

Large Scale Approximation

Micrometrical steps have to be following to get closer to the sample surface. To protect the tip from collisions cause from vibration and external interaction, surface and tip is separated by micrometres. These steps increase the speed and decrease the set up time of the system.

Small Scale Approximation

The device move the tip until it sensed the shear-force section when the system is close enough to be reachable by the bimorph piezoelectric. The shear-force area is small and if the surface is hit, the steps made in this point are capable of breaking the tip of the system. The most sensible approach is the large scale. A distance reference indicator is required to know when the right time to change to the small-scale approximation.

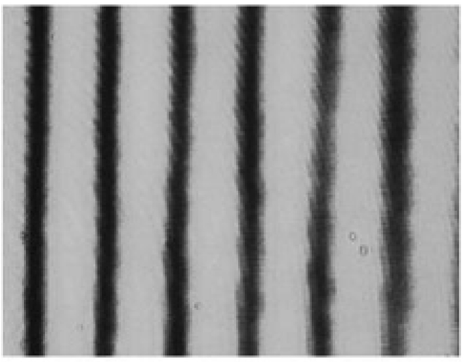


Fig. 5(a) The fringes form when the tips are far away

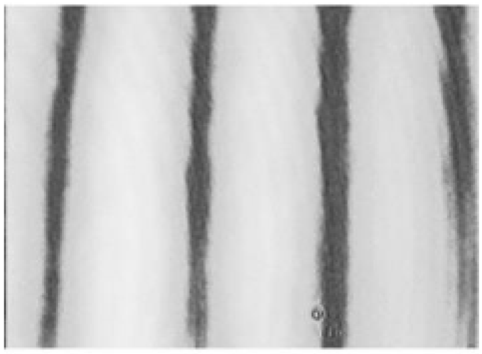


Fig. 5(b) The fringes when the tip is closer to the sample

Fig. 5 Interference fringes created at the sample surface

Some lines do not fit the camera sight and remains wider. For this experiment, the large-scale approximation is done until only one red line fits the entire screen of the webcam's view. Once the system approach using large-scale procedure is done, the small-scale approximation starts. This approach is made through software with the interface and end when the system decreases the value of its oscillation amplitude. This oscillation is produced by the sinusoidal signal exited with the lock-in amplifier that decrease in amplitude means the shear-force area is located [6].

CONCLUSION

In this paper, elaborately discuss different way to avoid accident or control accident by using fuzzy logic. Different algorithms are elaborated on, in this paper to minimize averted collision. For better resolution and faster response of the system, have done by the control optimization. Auto-Tune algorithm is to increase the efficiency by saving time. The Auto-Tune algorithm presented in this review is a tool to deal with environmental variations and it helps to tune the system in its maximum sensing capacity. ACSS algorithm is applied to the non-linear control of a class of servo system characterized by second-order models with integral component. The capability to vibrate proportionally by shear forces interaction that takes place in a scanning process. Here, Distance can be control by shear force. We looked at how supporting diagrams show in section-III, speed control by maintaining a particular distance and calculating the correct desire value by reducing the error using fuzzy logic control.

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