- Word Count: 1590

Plagiarism Percentage

5%

sources:

1 2% match (Internet from 28-Mar-2011)
http://fportfolio.petra.ac.id/user_files/04-012/SEMNAS_PETRA-Ian.pdf

2 1% match (publications)
Lilly, . "Mamdani Fuzzy Systems", Fuzzy Control and Identification Lilly/Fuzzy Control, 2010.

3 1% match (publications)
Bakar, Rosli Abu. "Computational Visualization and Simulation of Diesel Engines Valve Lift Performance Using CFD", American Journal of Applied Sciences/15469239, 20080501

4 1% match (Internet from 22-Aug-2014)
http://cms.iadlest.org/Portals/0/Files/Documents/DDACTS/Docs/TRB%20Special%20Report%20254%20-%20Managing%20Speed.pdf

paper text:

OPTIMUM METHOD SOLUTION FOR DETERMINING BRAKE DISTANCE DESIGN Ian Hardianto Siahaan, Amelia Sugondo, Willyanto Anggono Mechanical Engineering Department, Petra Christian University

Product Innovation and Development Centre Petra Christian University 1
Jl. Siwalankerto 142-144, Surabaya 60236 Email: ian@peter.petra.ac.id,
amelia **@peter.petra.ac.id, willy@petra.ac.id**

Abstract Fuzzy logic is a powerful method for mapping space input into space output. Between space input and output there is a black box for mapping input towards suitable output. Although many ways works with the black box, fuzzy logic will give powerful solution. The purpose of the research is looking for relation parameters between velocity and brake pressure of vehicle model that can be control to determine optimum brake distance of vehicle model by using rules base of fuzzy logic with verbose format. The step of research methodology are: determining space input variable of fuzzy logic i.e. : velocity and brake pressure, using fuzzy operator, using implication function, composing space fuzzy output of brake distance, and then processing of defuzzification. The result of this research has given optimum brake distance of model vehicle. Where as the maximum of velocity = 112 km/h and brake pressure (P brake) = 80 bars will give minimum brake distance = 24.90 meters, if brake pressure ≤ 22.8 bars will give maximum braking distance

= 52.30 meters. The conclusion is model vehicle with brake pressure 20 bars <P brake< 80 bars will give brake distance: 24.90 meters< S brake< 52.30 meters in working velocity. Keywords: Verbose, fuzzy logic, defuzzification 1. Introduction Fuzzy logic is a powerful solution method that was invented by Professor Lotfi A Zadeh. Today, application method with fuzzy logic is not limited only for mathematics but all of knowledge sciences can use this method. Automotive design is one application science that using this solution method. Fuzzy logic solution method can determine the real optimum condition according to output targeted needed. Mostly, fuzzy logic solution methods can solve linear or nonlinear mathematics models in mechanical engineering control system or complex system. Brake distance is an important parameter needed to design braking system. Braking system hardware is safety device that should considered perfectly by automotive designer, because it can influence sum of human accidental on the streets. If the braking system could be success at high speed, the vehicle will crashed one to another vehicle. Then, we need to design brake pressure min to hindrance the situation. The point consideration of this research, if the total weights of vehicle is bigger than other vehicle will cause braking distance increase as effect of mass inertia. So do not ever stop in front of trucks or buses because they need more time to stop according to their weights. Otherwise, vehicle or motor should make a priority for train through railway, because train needs braking distance until 500 meters to stop at emergency condition. THE 6TH INTERNATIONAL CONFERENCE ON NUMERICAL ANALYSIS IN ENGINEERING 2. Theoretical Background Brake distance design has variation parameter and depend on parameter is influenced to friction coefficient tire and road surface. Otherwise, they could be depend on type of tire and reaction time (mostly, it is assumed that human needs standard time concentration to operate brake until 1/3 second). Other factor that we have to consider is brake attitude according to braking process to reach front or back tire stabilization. Empirical formula for a vehicle on the road can explain according to equation 1, below: d? V2 (254 * f) (1) d =

Braking distance, m V = Initial speed, km/h f = Friction **coefficient** **4**

Empirical formula for up grade stopping distance can be calculated using equation 2, below: d? V 2 [254 * (f ? G)] (2) G = Percentage up grade/100 For up grade stopping distance condition is lower stopping distance than down grades condition. Table.1, explain general standard can be applied to practical approximation for braking distance on the road suitable to equation 1. Table.1. Approximate Stopping Distance As well as type of vehicles and Weight of Load being Carried (8 Spee d (mp h) Speed conversi on (km/jam) Thingk ing Distan ce (m) Braki ng Dista nce (m) Overall Stoppin g Distanc e (m) 20 32 6 6 12 30 48 9 14 23 40 64 12 24 36 50 80 15 38 53 60 96 18 55 73 70 112 21 75 96 Approximation according to Mr. Alex Beet, overall stopping distance could be equation 3: X 2 +X = Overall stopping distance (ft), 20 (3) X = Speed (mph), For example: vehicle average length can be approximate 15 ft, so that overall stopping distance will be 75 ft in working velocity 30 mph. It shows that there are five cars along space in front of the vehicle reference. While follow another vehicle, do not ever follow near close, because this condition always cause human accidental because it needs more time to stop at normal condition. Normally time to stand for brake distance only during 2 second to stop or to hindrance situation. The impression of the analysis can applied vehicle speed optimization between 32 km/hours - 112 km/hours; it is caused that vehicle normal operation in this working velocity. Meanwhile, normal brake pressure operation between 0-80 bars. Otherwise, membership function could be determined by software modeling to analysis the output target needed. ARTIFICIAL INTELEGENCE APPLICATION IN ENGINEERING 2-17 Membership Function for Vehicle Speed, Brake pressure, and Brake Distance. Fuzzy logic Mamdani’s can explain the figures below to control output brake distance and input vehicle speed and brake pressure. Fig.4. Input-output Fuzzy Logic Fig.5. Membership function input-output Fuzzy Logic Fig.6. Rule Viewer Fuzzy logic Mamdani’s can

be determined vehicle brake distance suitable to format verbose: - If vehicle speed is low and brake pressure is low then brake distance is min. - If vehicle speed is low and brake pressure is high then brake distance is min. - If vehicle

speed is medium and **brake pressure is** **2**

low then brake distance is max. - If vehicle

speed is medium and **brake pressure is** **2**

high then brake distance is min. - If vehicle speed is high and brake pressure is low

then brake pressure is max. - **If** vehicle **speed is** high and **brake pressure is** **2**

high) then brake pressure is min. THE 6TH INTERNATIONAL CONFERENCE ON NUMERICAL ANALYSIS IN ENGINEERING 3. Research Methodology Research experimentation to find output targeted can be express by using flowchart procedure figure 7. Start Collect Data Fig.8. 3D Parameter relationship Vehicle Speed, Brake Pressure and Brake Distance Vehicle Input Parameters Operator's Fuzzy Mamdani's By using software ruler viewer, it can displayed input and output simulation to readability about responds surface above (fig.8). Table.2. Optimization Results by Using Rule Base Determination Fuzzy Logic Rule Vehicle Brake Brake distance Speed Pressure Optimization Output Composition Brake Distance (Km/Jam) Input Using Fuzzy Fuzzy Logic Logic 32 20 bar 30,50 m 40 bar 30,50 m Defuzzification Processing 60 bar 30,50 m 80 bar 30,50 m 48 20 bar 41,90 m 40 bar 39,50 m Output Research 60 bar 35,90 m 80 bar 32,60 m 64 20 bar 45,30 m End 40 bar 39,50 m 60 bar 35,90 m 80 bar 32,60 m Fig.7. Research Procedure 80 20 bar 47,40 m 40 bar 42,70 m 60 bar 33,10 m 4. Results Discussion 80 bar 30,50 m 96 20 bar 50,70 m Output results by using fuzzy logic can be got 40 bar 46,90 m 3D Parameter relationship input and output 60 bar 29,00 m parameters braking distance in working 80 bar 27,00 m velocity, i.e. 112 20 bar 52,30 m 40 bar 47,50 m 60 bar 28,30 m 80 bar 24,90 m ARTIFICIAL INTELEGENCE APPLICATION IN ENGINEERING 2-19 Conclusions Results analysis by using fuzzy logic controller can be determined some conclusions. - Braking distance from a vehicle can show us working velocity and brake pressure as input system. - Table.2 can explain to us that max velocity 112 km/hours and brake pressure 80 bars will give minimum of brake distance design, meanwhile brake pressure 20 bars will give max brake distance design. - By using fuzzy logic rule we can get interface for ECU (Electronic Control Unit) to converse language program with assembler language. - PID Controller can be prepared to set parameters stabilization. - Design of brake pressure vehicle should be attention to the result of this research include brake pressure design or operation brake pressure of the vehicle. Acknowledgements I dedicate this research paper to mechanical engineering department at Petra Christian University (PCU). Thank you for all of supported staff to finish this paper. References [1] Denton Tom (1995),Automobile Electrical and Electronic System, Edward Arnold Division, London. [2] Mechanical Simulation Corporation (1996-2005), Car Simulation Demonstration Presentation & Video, USA. [3] http://www.mobilmotor.co.id/news_det ail.asp?id=1364 [4] Sutantra, I Nyoman (2001), Teknologi Otomotif, Teori dan Aplikasinya,Surabaya, Guna Widya. [5] Wong, J

Y (1978), Theory of Ground Vehicle (2nd ed), Ottawa, John Willey & Sons, New York. [6] [7] [8] Kusumadewi, Sri, Artificial Intelligence, Edisi Pertama, Yogyakarta Math Works, Incorporated (2003) , Matlab ToolBox Documentation, Software Licence. AASHTO's (1994), A Policy on Geometric Design Professional Practice of Highway and Street, pp.119, 121, 124," THE 6TH

THE 6TH

INTERNATIONAL CONFERENCE ON NUMERICAL ANALYSIS IN ENGINEERING 3

THE 6TH

INTERNATIONAL CONFERENCE ON NUMERICAL ANALYSIS IN ENGINEERING 3

2-16 ARTIFICIAL INTELEGENCE APPLICATION IN ENGINEERING 2-18 ARTIFICIAL INTELEGENCE APPLICATION IN ENGINEERING 2-20 ARTIFICIAL INTELEGENCE APPLICATION IN ENGINEERING