

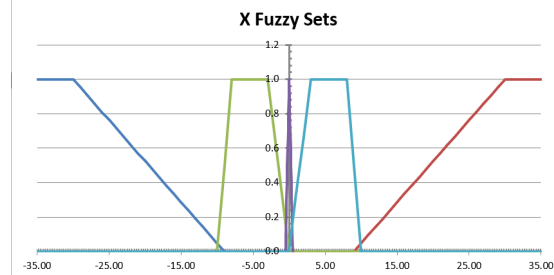
ALGORITHM (FUZZY CONTROLLER) DOCUMENTATION GUIDE

Provide the required details using the following guide.

Components	Details	Intructions
Inputs	$X = A * \theta + B * \dot{\theta}$ $Y = C * x + D * \dot{x}$ $A=3, B=0.4, C=4.5, D=4;$	Specify all the inputs, including the coefficients (constants). Note: This assignment requires implementing Yamakawa's fuzzy controller design.
Fuzzy Rules	$X(\text{angle}): \text{NL } Y(x): \text{PL } \text{out}: \text{NM}$ $X(\text{angle}): \text{NL } Y(x): \text{PS } \text{out}: \text{NS}$ $X(\text{angle}): \text{NL } Y(x): \text{ZE } \text{out}: \text{NL}$ $X(\text{angle}): \text{NL } Y(x): \text{NS } \text{out}: \text{NS}$ $X(\text{angle}): \text{NL } Y(x): \text{NL } \text{out}: \text{NVL}$ $X(\text{angle}): \text{NS } Y(x): \text{PL } \text{out}: \text{NS}$ $X(\text{angle}): \text{NS } Y(x): \text{PS } \text{out}: \text{NM}$ $X(\text{angle}): \text{NS } Y(x): \text{ZE } \text{out}: \text{NS}$ $X(\text{angle}): \text{NS } Y(x): \text{NS } \text{out}: \text{NL}$ $X(\text{angle}): \text{NS } Y(x): \text{NL } \text{out}: \text{NS}$ $X(\text{angle}): \text{ZE } Y(x): \text{PL } \text{out}: \text{NM}$ $X(\text{angle}): \text{ZE } Y(x): \text{PS } \text{out}: \text{NS}$ $X(\text{angle}): \text{ZE } Y(x): \text{ZE } \text{out}: \text{ZE}$ $X(\text{angle}): \text{ZE } Y(x): \text{NS } \text{out}: \text{NS}$ $X(\text{angle}): \text{ZE } Y(x): \text{NL } \text{out}: \text{PM}$ $X(\text{angle}): \text{PS } Y(x): \text{PL } \text{out}: \text{PS}$ $X(\text{angle}): \text{PS } Y(x): \text{PS } \text{out}: \text{PL}$ $X(\text{angle}): \text{PS } Y(x): \text{ZE } \text{out}: \text{PS}$ $X(\text{angle}): \text{PS } Y(x): \text{NS } \text{out}: \text{PM}$ $X(\text{angle}): \text{PS } Y(x): \text{NL } \text{out}: \text{PS}$ $X(\text{angle}): \text{PL } Y(x): \text{PL } \text{out}: \text{PVL}$ $X(\text{angle}): \text{PL } Y(x): \text{PS } \text{out}: \text{PS}$ $X(\text{angle}): \text{PL } Y(x): \text{ZE } \text{out}: \text{PL}$ $X(\text{angle}): \text{PL } Y(x): \text{NS } \text{out}: \text{PS}$ $X(\text{angle}): \text{PL } Y(x): \text{NL } \text{out}: \text{PM}$	Specify the fuzzy rules used in your system.
Fuzzy Membership functions	$\text{NL}(X):$ $a = 0, b = 0, c = -30, d = -9$ $\text{NS}(X):$ $a = -10, b = -8, c = -3, d = 0$ $\text{ZE}(X):$ $a = -0.5, b = -0, c = 0, d = 0.5$ $\text{PS}(X):$ $A = 0, b = 3, c = 8, d = 10$ $\text{PL}(X):$ $a = 9, b = 30, c = 0, d = 0$	Specify the parameters of all membership functions used for each of the inputs. (e.g. input, type, fuzzy set name, $a=?$, $b=?$, $c=?$, $d=?$) Use the Fuzzy Sets Viewer Excel file to generate a diagram.

159302 (Artificial Intelligence)
Assignment #2

	a	b	c	d	type	Left_Slope	Right_Slope
NL	-30	-9	0	0	left	0	-0.0476
NM	-10	-8	-3	0	regular	0.5	-0.33333333
ZE	-0.5	0	0	0.5	regular	2	-2
PM	0	3	8	10	regular	0.3333333	-0.5
PL	9	30	0	0	right	0.047619	0



NL(Y):

$a = 0, b = 0, c = -2.1, d = -1.3$

NS(Y):

$a = -2.1, b = -1.3, c = -1.0, d = 0$

ZE(Y):

$a = -1.0, b = -0.5, c = 0.5, d = 1.0$

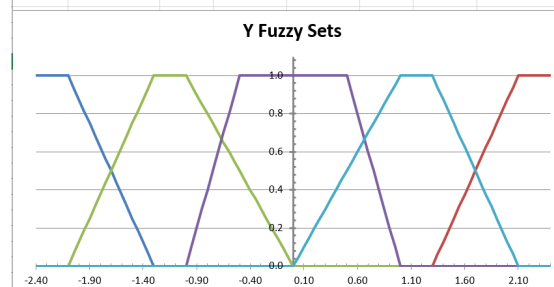
PS(Y):

$A = 0, b = 1.0, c = 1.3, d = 2.1$

PL(Y):

$a = 1.3, b = 2.1, c = 0, d = 0$

	a	b	c	d	type	Left_Slope	Right_Slope
NL	-2.1	-1.3	0	0	left	0	-1.2500
NM	-2.1	-1.3	-1	0	regular	1.25	-1
ZE	-1	-0.5	0.5	1	regular	2	-2
PM	0	1	1.3	2.1	regular	1	-1.25
PL	1.3	2.1	0	0	right	1.25	0



Defuzzification
Method

centroid defuzzification method.

Specify the method used.