٩٨٢١٠٧٨٤ ایمان شریفی

تمرین سری هفتم کنترل فازی

8.1-b)

$$\mu_{A_i^l}(x_i) = \begin{cases} 1 - \dfrac{|x_i - \bar{x}_i|}{\sigma_i^l} & , \text{ if } |x_i - \bar{x}_i^l| \le \sigma_i^l \\ 0 & , \text{ otherwise.} \end{cases}$$

Trangle fuzzifier $\Rightarrow$

$$\mu_{A'}(x) = \begin{cases} \min\left\{\left(1 - \dfrac{|x_1 - x_1^*|}{b_1}\right), \dots, \left(1 - \dfrac{|x_n - x_n^*|}{b_n}\right)\right\} & , \text{ if } |x_i - x_i^*| \le b_i \\ 0 & , \text{ otherwise} \end{cases}$$

$$\mu_{B'}(y) = \max\left\{\sup_{x \in U} \min\left(\mu_{A'}(x), \mu_{A_i^l}(x_i), \mu_B(y)\right)\right\}$$

میدانیم که مقدار $\sup\limits_{x \in U} \min$ درجایی اتفاق می‌افتد که

$$\left(1 - \frac{|x_i - \bar{x}_i|}{\sigma_i}\right) = \left(1 - \frac{|x_i - x_i^*|}{b_i}\right)$$

$$\Rightarrow \frac{|x_i - \bar{x}_i|}{\sigma_i} = \frac{|x_i - x_i^*|}{b_i} \rightsquigarrow \frac{x_i - \bar{x}_i}{\sigma_i} = \pm\left(\frac{x_i - x_i^*}{b_i}\right)$$

$$\Rightarrow x_i\left(1 \mp \frac{\sigma_i}{b_i}\right) = \bar{x}_i \mp \frac{\sigma_i}{b_i} x_i^* \Rightarrow \boxed{x_i = \frac{b_i \bar{x}_i \mp \sigma_i x_i^*}{b_i \mp \sigma_i}}$$

$$\rightarrow \mu_{B'}(y) = \left(1 - \frac{|x_i - \bar{x}_i|}{\sigma_i}\right) \times \mu_B(y)$$

$$= \left(1 - \frac{\left|\dfrac{b_i \bar{x}_i \mp \sigma_i x_i^*}{b_i \mp \sigma_i} - \bar{x}_i\right|}{\sigma_i}\right) \mu_B(y)$$

$$= \left(1 - \frac{\left|\sigma_i(\bar{x}_i - x_i^*)/b_i \mp \sigma_i\right|}{\sigma_i}\right) \mu_B(y)$$

$$= \left(1 - \left|\frac{\bar{x}_i - x_i^*}{b_i \mp \sigma_i}\right|\right) \mu_B(y)$$

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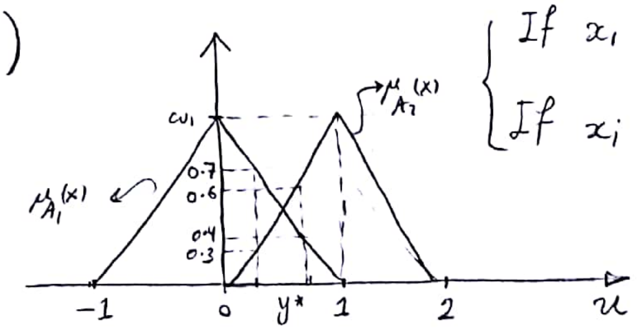
8-3-a)



$$\begin{cases} \text{If } x_1 \text{ is } A_1 \text{ and } x_2 \text{ is } A_2 \text{ Then } y \text{ is } A_1. \\ \text{If } x_i \text{ is } A_2 \text{ and } x_2 \text{ is } A_1, \text{ Then } y \text{ is } A_2. \end{cases}$$

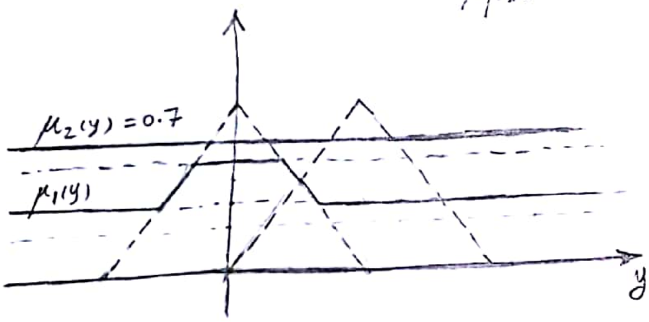
$$\begin{cases} \mu_{A_1}(u) = \begin{cases} 1-|u| & -1 \le u \le 1 \\ 0 & \text{otherwise} \end{cases} \\ \mu_{A_2}(u) = \begin{cases} 1-|u-1| & 0 \le u \le 2 \\ 0 & \text{otherwise} \end{cases} \end{cases}$$

$(x_1^*, x_2^*) = (0.3, 0.6)$

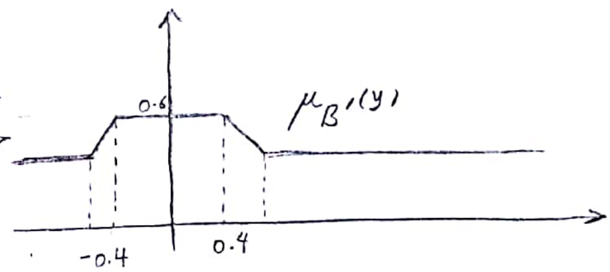
$$\mu_{B'}(y) = \min\left\{ \sup_{x \in U} \min\left(\mu_{A'}(x), \max\left(\min\left(\mu_{A_i}(x), \mu_B(y)\right), 1-\min\left(\mu_{A_i}(x_i)\right)\right)\right)\right\}$$

$$= \min\left\{\left(1, \max\left(\min\left(0.6, \mu_{B_1}(y)\right), 0.4\right)\right), \left(1, \max\left(\min\left(0.3, \mu_{B_2}(y)\right), 0.7\right)\right)\right\}$$

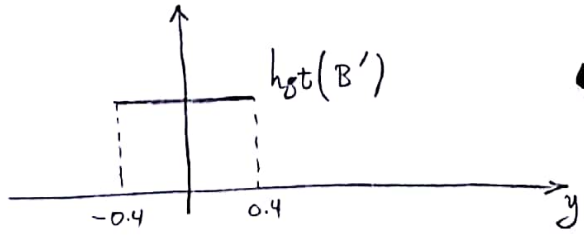
$$= \min\left\{ \max\left(\underbrace{\min\left(0.6, \mu_{A_1}(y)\right), 0.4}_{\mu_1(y)}\right), \max\left(\underbrace{\min\left(0.3, \mu_{A_2}(y)\right), 0.7}_{\mu_2(y)}\right)\right\}$$



min $\Rightarrow$



$\Rightarrow y^* =$ any point in $hgt(B')$



if choose defuzzifier Smallest, So $\quad y^* = \inf\{y \in hgt(B')\} = -0.4$

if choose deffuzzifier Largest, So $\quad y^* = \sup\{y \in hgt(B')\} = 0.4$

if " " mean, So $\quad y^* = \dfrac{\int_{-0.4}^{0.4} y\,dy}{\int_{hgt(B')} dy} = 0$

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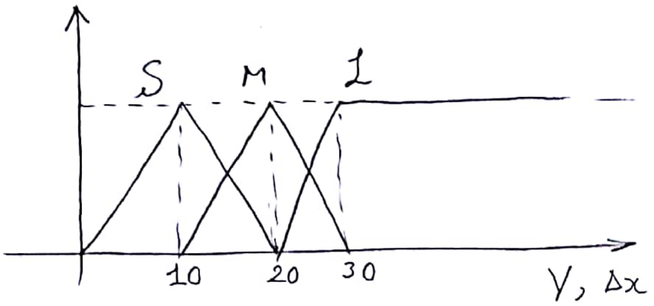
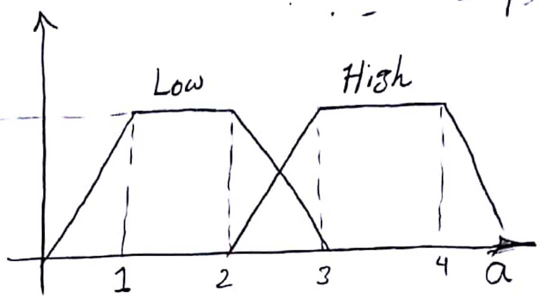
8.4) if V is S. and Δx is L, Then a is High.

if V is L and Δx is S, Then a is Low.

if V is M and Δx is M, Then a is Low,

سیستم کنترل تعقیب ربات :





$(V^*, \Delta x^*) = (1{,}4, 2.6) \times 10$

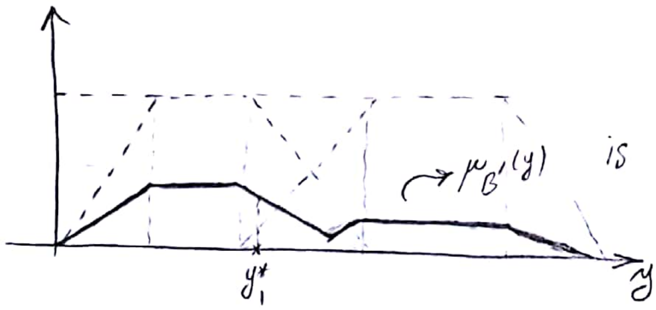
product Inference Engine (PIE) is used.

$$\mu_{B'}(y) = \max\Big[\mu_S(1{,}4)\mu_L(2.6)\mu_{High}(y), \mu_L(1{,}4)\mu_S(2.6)\mu_{Low}(y)$$

$$, \mu_M(1{,}4)\mu_M(2.6)\mu_{Low}(y)\Big]$$

$$= \max\big[0.36\,\mu_{High}(y), 0, 0.16\,\mu_{Low}(y)\big]$$

$\Rightarrow$



is a non-convex membership function.

using Center of Gravity Defuzzifier.

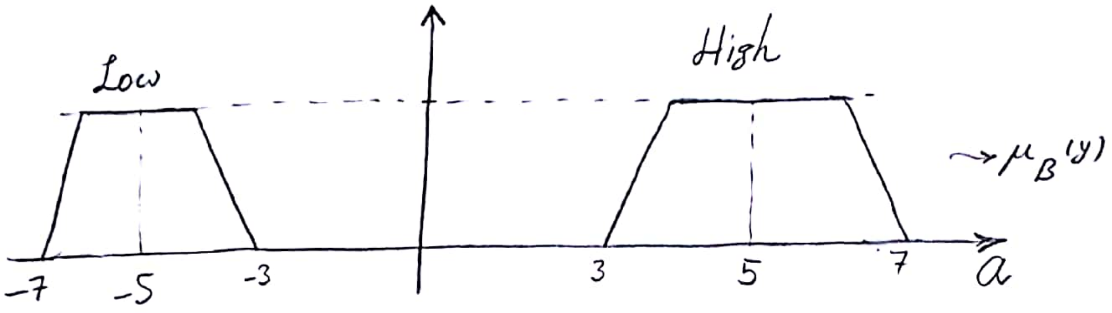
$$y_1^* = \frac{\int y\,\mu_{B'}(y)\,dy}{\int \mu_{B'}(y)\,dy} \simeq 2.0$$

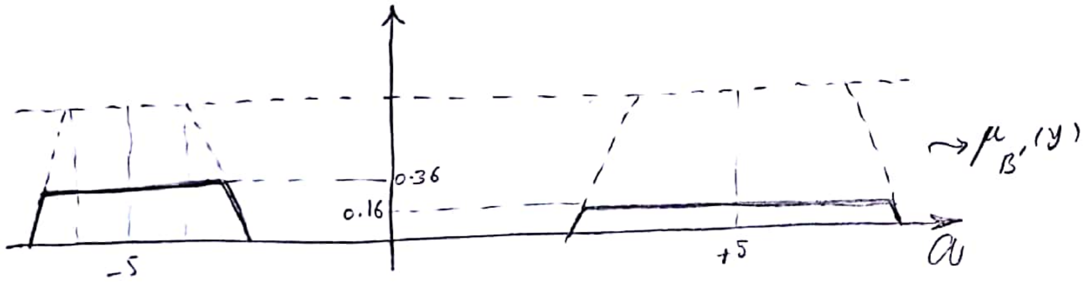
using Center of average defuzzifier. $y_2^* = \dfrac{\sum \bar{y} w_i}{\sum w_i} = \dfrac{1{,}5 \times 0.36 + 3{,}5 \times 0.16}{0.36 + 0.16}$

$= 2{,}11$

★ در توابع non-Convex پیوسته، شکلی وجود نباید.

حال فرض کنید به‌جای توابع عضویت خروجی قبل از توابع زیر استفاده شود :





$$\text{using CGD} \rightsquigarrow y^* = \frac{\int_a y\,\mu_{B'}(y)\,dy}{\int_a \mu_B(y)\,dy} \in [-1, 1]$$

$$\text{using CAD} \rightsquigarrow y^* = \frac{\sum y_i w_i}{\sum w_i} \in [-1, 1]$$

★ همان طور که مشاهده می‌کنید مقدار y^* در بازه $[-1, 1]$ است و از طرفی در این بازه $\mu_a(y^*)$ برابر صفر می‌باشد یعنی در این بازه مقدار عضویت $\mu_{B'}(y)$ صفر است در صورتی که y^* در این نقطه بدست آمده یعنی مقدار عضویت y^* غیر صفر در نتیجه تناقض وجود دارد .

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