Fuzzy Modelling

Exercise 2

Write a script to draw a symmetrical trapezoidal membership function and Gaussian membership functions, which are described by the following mathematical relations:

a)

$$\mu_A(x) = \begin{cases} 0 \text{ for } x = 0 \\ 1 \text{ for } x = 3 \\ 1 \text{ for } x = 5 \\ 0 \text{ for } x = 8 \end{cases}$$

DS = 0.25 R=[-15, 15]

$$\mu_B(x) = e^{-(\frac{x-5}{2})^2}$$

$$\mu_C(x) = e^{-(\frac{x+8}{4})^2}$$

C1 – magenta C2 – cyan C3 – red

b)

$$\mu_A(x) = \begin{cases} 0 \text{ for } x = 0 \\ 1 \text{ for } x = 4 \\ 1 \text{ for } x = 6 \\ 0 \text{ for } x = 10 \end{cases}$$

DS = 0.20 R=[-15, 15]

$$\mu_B(x) = e^{-(\frac{x-4}{3})^2}$$

$$\mu_C(x) = e^{-(\frac{x+7}{4})^2}$$

C1 – green C2 – magenta C3 – blue

Draw the membership functions $\mu_A(x)$, $\mu_B(x)$ and $\mu_C(x)$ on one graph in the range of R. Use a DS discretization step and the following colors $\mu_A(x)$ – C1, $\mu_B(x)$ – C2 and $\mu_C(x)$ – C3.

Write the equations describing the support, the core and the α-cut of a fuzzy set. Determine the support and core of the fuzzy sets: support (A), core(A), core(B) and core(C). Determine the α-cut of the fuzzy sets: α-cut(A) for α=0.2 and α-cut(B) for α=0.5.