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Sr. No.....

Dec 2018

B.Tech. VIIIth SEMESTER

Fuzzy Control System (EIC 410)2010 Scheme

Time: 3 Hours

Max. Marks:60

- Instructions**
1. It is compulsory to answer all the questions (2 marks each) of Part -A in short.
 2. Answer any four questions from Part -B in detail.
 3. Different sub-parts of a question are to be attempted adjacent to each other.
 4. Assume any missing Data.

PART -A

- Q1 (a) What is the reason that fuzzy logic has rapidly become the most successful technology for sophisticated control system? (2)
- (b) What is a membership function of a fuzzy set? Can a fuzzy membership be True and False at the same time? (2)
- (c) What are the difficulties involved in stability analysis of fuzzy control system? (2)
- (d) State the difference between probability and fuzzy logic. (2)
- (e) What is an adaptive fuzzy system? (2)
- (f) Consider two fuzzy sets A and B. Find complement and union. (2)

$$A = \left\{ \frac{1}{2} + \frac{0.5}{3} + \frac{0.6}{4} + \frac{0.2}{5} + \frac{0.6}{6} \right\} \quad B = \left\{ \frac{0.5}{2} + \frac{0.8}{3} + \frac{0.4}{4} + \frac{0.7}{5} + \frac{0.3}{6} \right\}$$

- (g) Define linguistic variable. What is the notion of such variable? (2)
- (h) Discuss in short fuzzy if then statement. (2)
- (i) How the choice of variables is done in PID like FKBC. (2)
- (j) What do you understand by normalization and denormalization? (2)

PART -B

- Q2 (a) Name three strengths and three weaknesses of fuzzy expert systems. (4)
- (b) Consider fuzzy relations (6)

$$R = \begin{matrix} & \begin{matrix} y_1 & y_2 \end{matrix} \\ \begin{matrix} x_1 \\ x_2 \end{matrix} & \begin{bmatrix} 0.7 & 0.6 \\ 0.8 & 0.3 \end{bmatrix} \end{matrix} \quad S = \begin{matrix} & \begin{matrix} z_1 & z_2 & z_3 \end{matrix} \\ \begin{matrix} y_1 \\ y_2 \end{matrix} & \begin{bmatrix} 0.8 & 0.5 & 0.4 \\ 0.1 & 0.6 & 0.7 \end{bmatrix} \end{matrix}$$

Find the relation T= RoS using max-min and max-product composition.

- Q3 (a) What is the purpose of defuzzification? Discuss the methods used for defuzzification. (6)
- (b) What are the design parameters for fuzzification module and inference engine? (4)

- Q4 (a) Explain sliding mode FKBC in detail. (5)
 (b) Discuss the advantages and disadvantages as related to Surgeon and Mamdani type fuzzy controller. (5)
- Q5 (a) Explain how self organizing controllers help to achieve better control on parameter variation? (5)
 (b) For the design of adaptive fuzzy controllers how gradient descent algorithm helps to the membership function tuning? (5)
- Q6 (a) Draw the block diagram of model based controller and explain each block briefly. (5)
 (b) How the knowledge based systems are classified? Explain. (5)
- Q7 (a) How Phase Plane method help to find out the stability of fuzzy systems? Why this approach is restricted to second order systems? (7)
 (b) What is small gain theorem? (3)