EIC-May 2018

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B.Tech. EIC 8th Semester Examination
FUZZY CONTROL SYSTEM (EIC-410)

Time : 3 Hours] [Max. Marks : 60

Instructions :

(i) All sub-parts of question no. 1 (Part-A) are compulsory (2 marks each).

(ii) Different sub-parts of a question be attempted adjacent to each other.

(iii) Answer any four questions from Part-B; each carries 10 marks.

(iv) Use of A-4 size graph paper and non-programmable calculator is permitted.

PART–A

1. (a) Define fuzzy implication; what is its role in Inferencing? (2)

(b) Why triangular fuzzy sets are often used but Gaussian memberships are generally avoided? (2)

(c) What is the basis of deriving rules for FKBCs? (2)

(d) In what ways knowledge can be represented in FKBCs? (2)

(e) Is FKBC essentially non-linear? Which blocks, if any, of FKBC are linear? (2)

(f) What is the purpose of fuzzification and with what intent the fuzzy output of FLC is again defuzzified? (2)

(g) What do you mean by cylindrical extension? (2)

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(h) How is complement of a fuzzy set defined? (2)

(i) Do the membership grades of an entity in different fuzzy sets necessarily total to one? Is the situation similar to sum of probabilities of all outcomes of an event? (2)

(j) Define input-output stability. (2)

PART-B

2. (a) Take 'A' as a fuzzy set of bell shape. Draw A and its complement A^C, then perform the operations : (i) [(A) intersection (A^C)]; (ii) [(A) union (A^C)]. Draw the resultant shapes too. How are the results different from corresponding operations on classical sets? (6)

(b) Define max-min composition of fuzzy relations. What is its physical interpretation? (4)

3. (a) Explain the choice of input and output variables, choice of input and output scaling factors and the choice of Universe of Discourse (U.O.D.). (7)

(b) Draw FKBC architecture. (3)

4. Let E be error and u be control output. Consider fuzzy sets as shown in Fig. 1, together with fuzzy rule base : (10)

(a) If E is P, Then u is N,

(b) Else If E is N, Then u is P.

Suppose actual input is 0.5. Infer Fuzzy control output using Compositional Rule of Inference (C.R.I.).

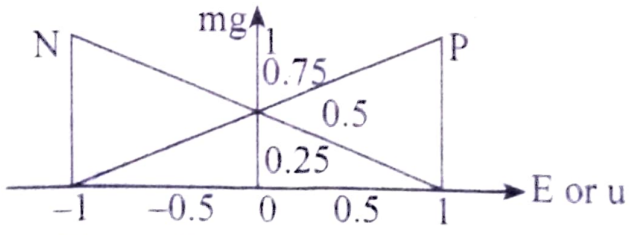

Fig. 1: Two Fuzzy Sets : Negative (N) and Positive (P)

5. (a) Which are the two yard-sticks that need to be applied to show linearity of a system? Prove the non-linearity or otherwise of Inferencing block of FKBC. (7)

(b) What are three main differences of Mamdani Type and TSK Type FKBCs? (3)

6. What parameters are tunable in an FLC? Explain membership function tuning using gradient descent approach. (10)

7. (a) Draw block diagram of adaptive FKBC. What extra components it has besides those in the standard fuzzy controller? Describe any of these extra components. (6)

(b) Write a brief technical note on stability of fuzzy control system. (4)
