國 立 臺 北 科 技 大 學

九十九學年第二學期電機系博士班資格考試

模糊控制 試題

注意事項：

1. 本試題共【7】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間:二小時。

1. (30 %)　Explain the following terminologies for fuzzy systems,
   a) Fuzzy set,
   b) Linguistic variable,
   c) Fuzzy number,
   d) Fuzzy relation,
   e) Composition of fuzzy relations,
   f) Radial-Basis-Function (RBF) Networks.

2. (10 %)　Describe the **similarities** and **differences** for fuzzy control and conventional control.

3. (10 %)　Explain the meaning of the statement
   "Fuzzy systems are universal approximators"

4. (15 %)
   a) Describe the architecture of **indirect** fuzzy control system;
   b) Describe the architecture of **direct** fuzzy control system;
   c) Make a comparison for the above two systems.

5. (10 %) Describe the procedure of using Lyapunov method to show the stability for a linear system $\dot{x} = Ax$.

6. (10 %) Consider the unforced fuzzy system model:

$$\dot{x} = \sum_{i=1}^{2} \alpha_i A_i x,$$

where α_1, $\alpha_2 \geq 0$ and $\alpha_1 + \alpha_2 = 1$. If both A_1 and A_2 are asymptotically stable, is the fuzzy system stable? Prove it or give a counter example.

7. (15 %) Consider the following nonlinear system:

$\dot{x}_1 = x_1 + x_2 \sin x_1 + u$

$\dot{x}_2 = x_1 \cos x_1 - x_2$

Construct a T-S fuzzy system (e.g., IF …, THEN …..) which can represent the nonlinear system exactly.