

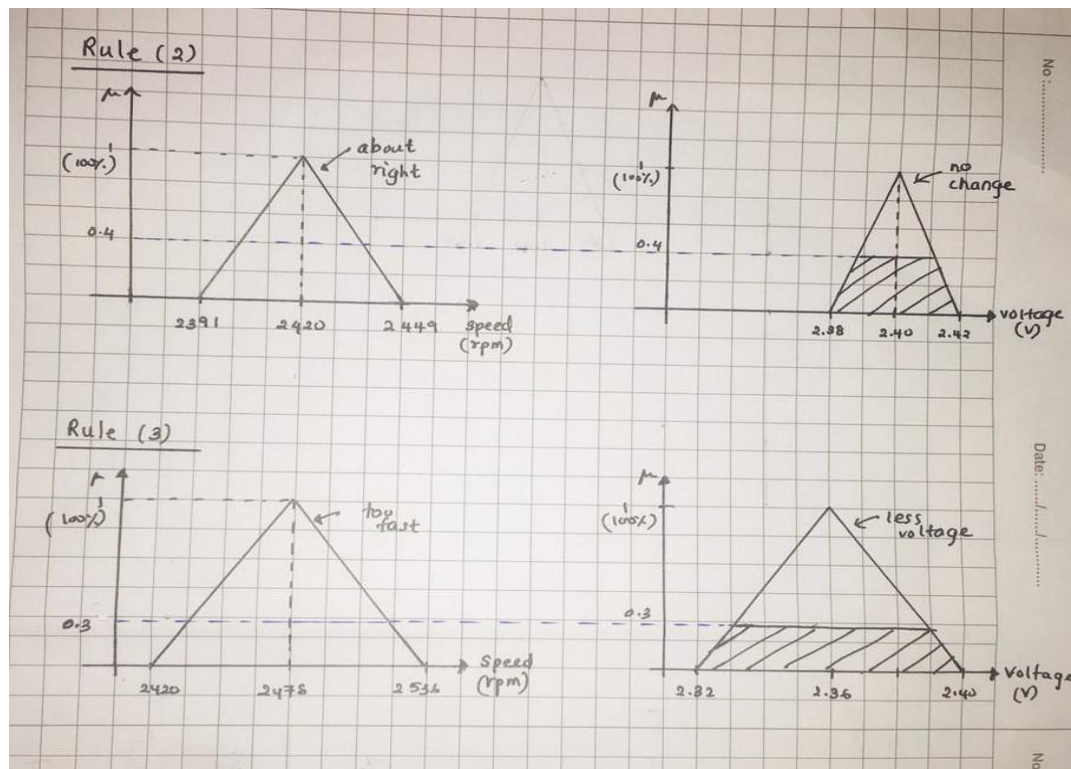
CO542 – Neural Networks and Fuzzy Systems

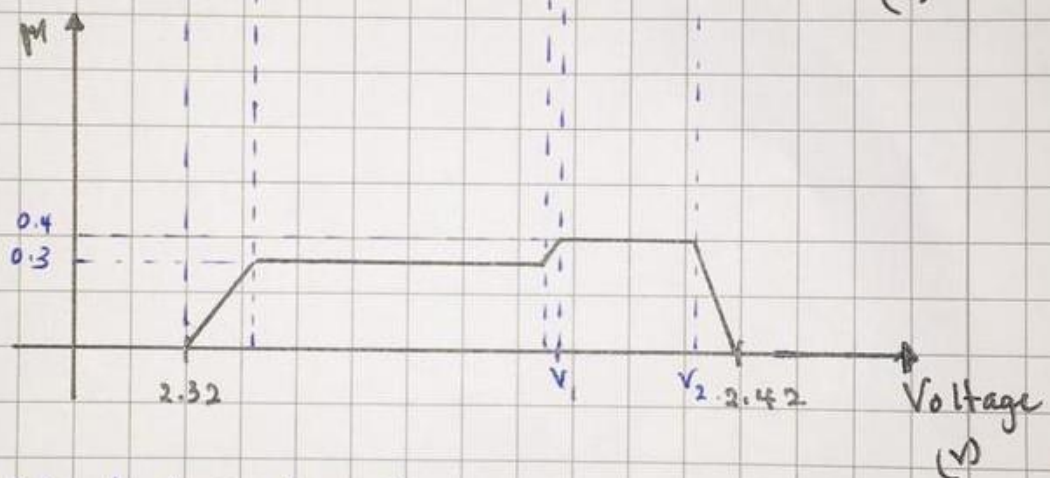
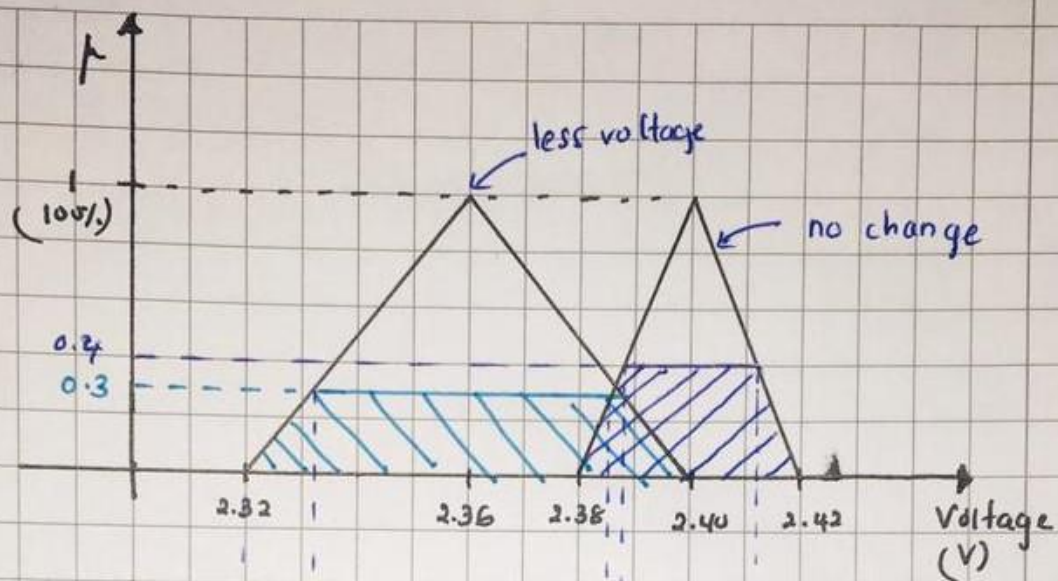
Lab 01: Fuzzy Logic

E/16/232

1. Rule-base for the scenario :
 - 1) If the motor speed is too slow, then more voltage applied.
 - 2) If the motor speed is about right, then no change in voltage.
 - 3) If the motor speed is too fast, then less voltage applied.
2. Here the speed increases from 2420 set point to 2437.4 rpm. The measured speed 2437.4 rpm intersects the 'about right' triangle and 'too fast' triangle at 0.4 and 0.3 respectively. Therefore the measured speed intersects both rule 2 and rule 3 triangles.

Using Mamdani Model and maximum defuzzification method:





for triangle 'no change',

$$\frac{1}{2.40 - 2.38} = \frac{0.4}{V_1 - 2.38} ; \quad \frac{1}{2.42 - 2.40} = \frac{0.4}{2.42 - V_2}$$

$$V_1 = 2.388$$

$$V_2 = 2.412$$

Using maximum defuzzication method (mean of maxima) (MOM)

$$V = \frac{V_1 + V_2}{2} = \frac{2.388 + 2.412}{2}$$

$$V = \underline{\underline{2.40 \text{ V}}}$$

3. Using Fuzzy Logic tool box in MatLab

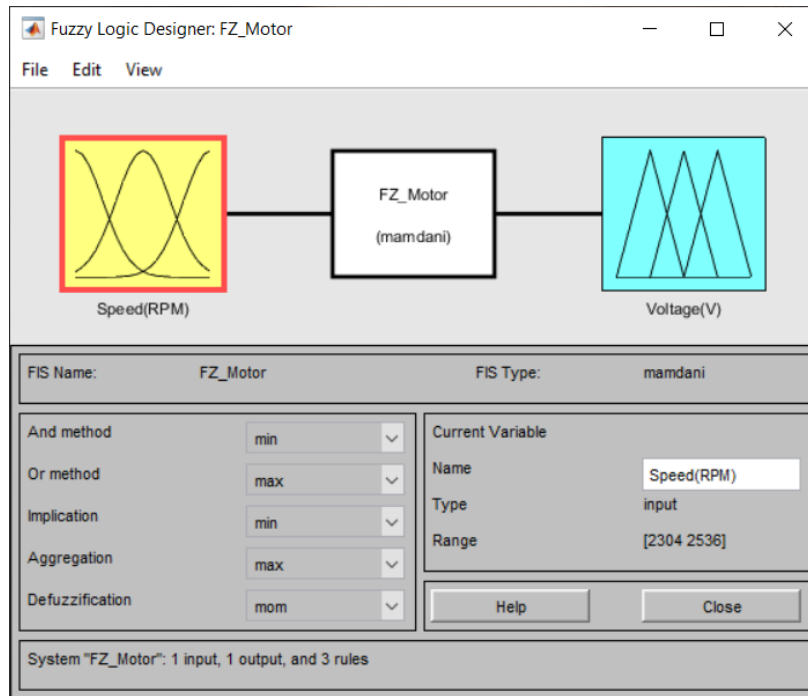


Figure 1: Fuzzy Interference System (FIS) Editor Window

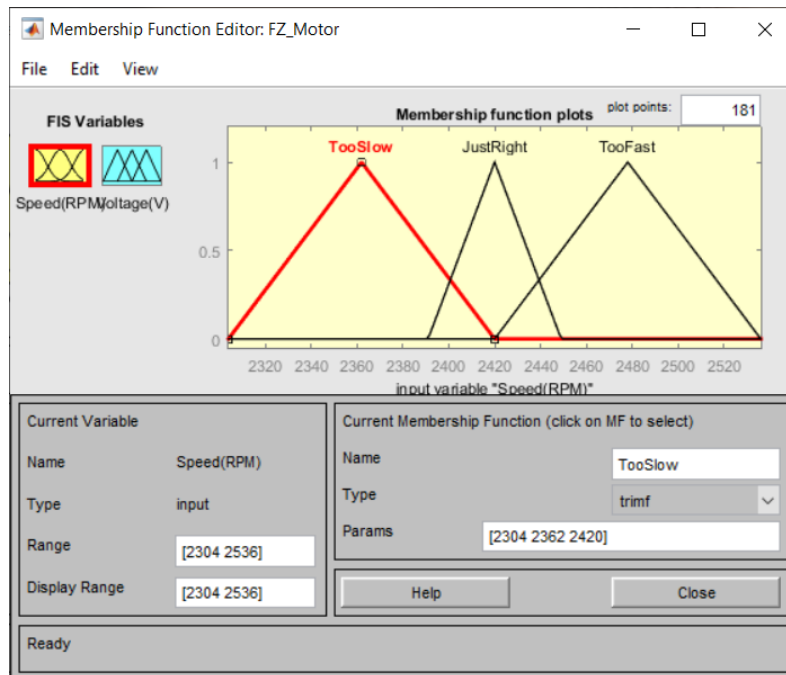


Figure 2: Input Membership Function Editor Window

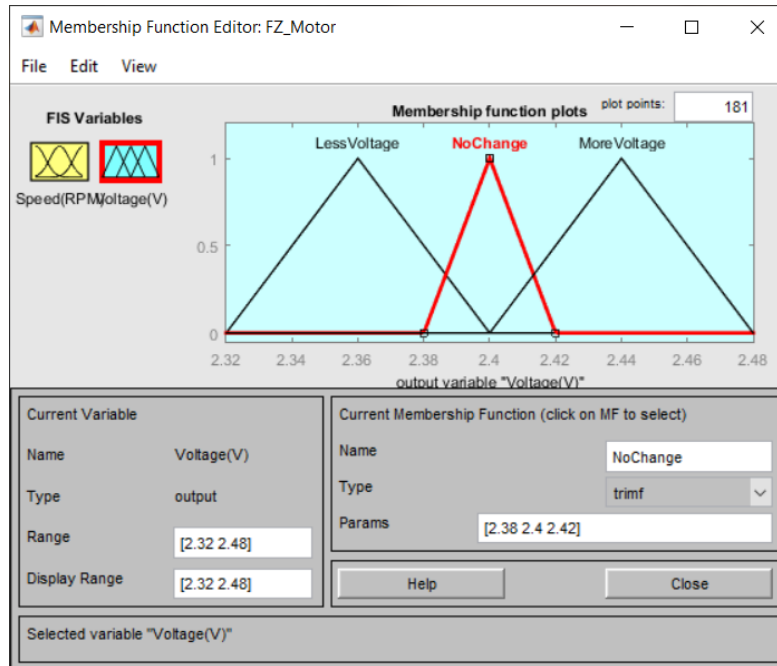


Figure 3: Output Membership Function Editor Window

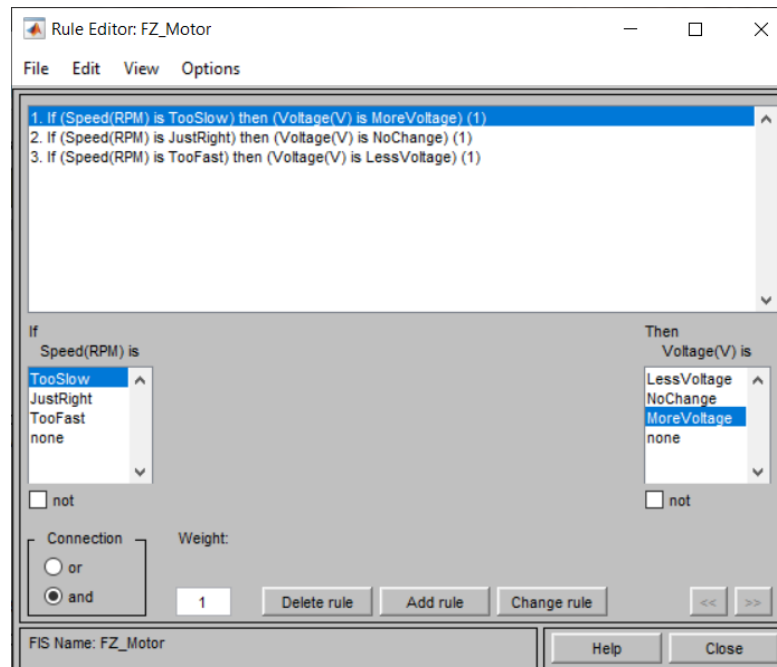


Figure 4: Rule Editor Window

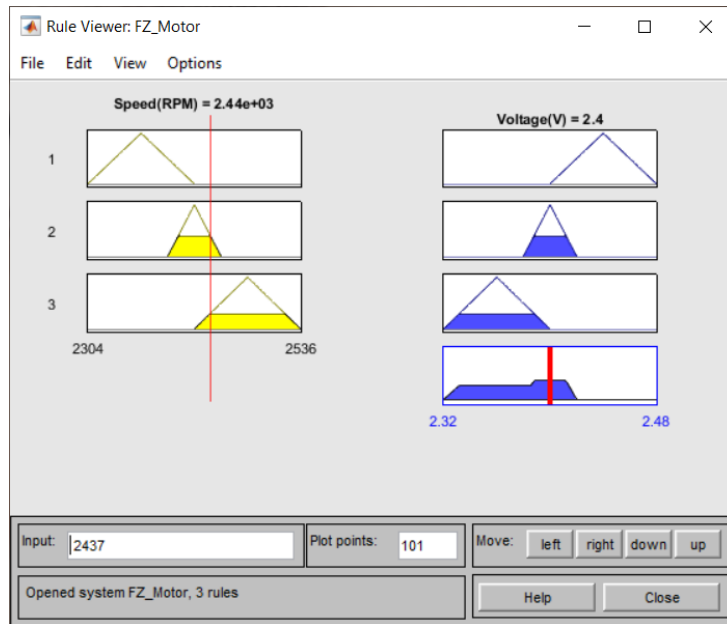


Figure 5: Output View

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Command Window

>> fis = readfis ('FZ_Motor')

fis =

    name: 'FZ_Motor'
    type: 'mamdani'
    andMethod: 'min'
    orMethod: 'max'
    defuzzMethod: 'mom'
    impMethod: 'min'
    aggMethod: 'max'
    input: [1x1 struct]
    output: [1x1 struct]
    rule: [1x3 struct]

>> out = evalfis(2437.4,fis)

out =

    2.4000

fx >> |

```

Figure 6: Cmd_Output View