

01.

	Angle					
Angular Velocity		NH	NL	Z	PL	PH
	NH	NH	NH	NH	NL	Z
	NL	NH	NH	NL	Z	PL
	Z	NH	NL	Z	PL	PH
	PL	NL	Z	PL	PH	PH
	PH	Z	PL	PH	PH	PH

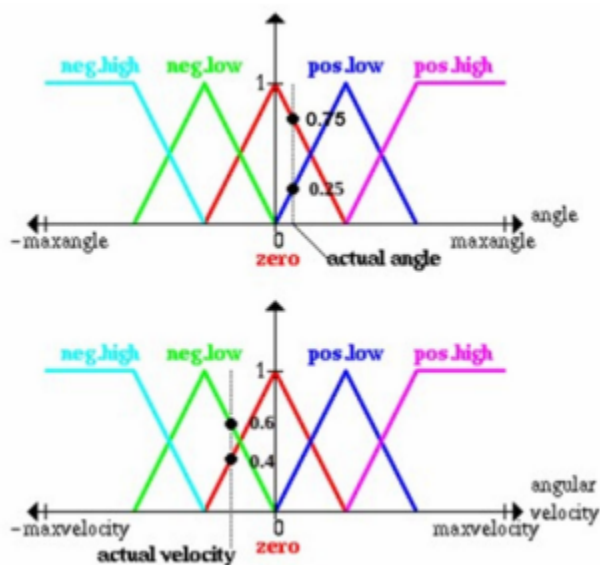
02.

Step 1: Identify the relevant rules for this case

1. If angle is zero and velocity is zero then force is zero
2. If angle is zero and velocity is NL then force is NL
3. If angle is PL and velocity is zero then force is PL
4. If angle is PL and velocity is NL then force is zero

Step 2 :

By considering the given graph



1. If angle is zero and velocity is zero then force is zero - u33

$$u_{33} = 0.40 \times 0.75 = 0.30$$

2. If angle is zero and velocity is NL then force is NL - u23
 $u23 = 0.60 \times 0.75 = 0.45$
3. If angle is PL and velocity is zero then force is PL - u34
 $u34 = 0.40 \times 0.25 = 0.10$
4. If angle is PL and velocity is NL then force is zero - u24
 $u24 = 0.60 \times 0.25 = 0.15$

Step 3

$$\text{force} = (Z * u33 + NL * u23 + PL * u34 + Z * u24) / (u33 + u23 + u34 + u24)$$

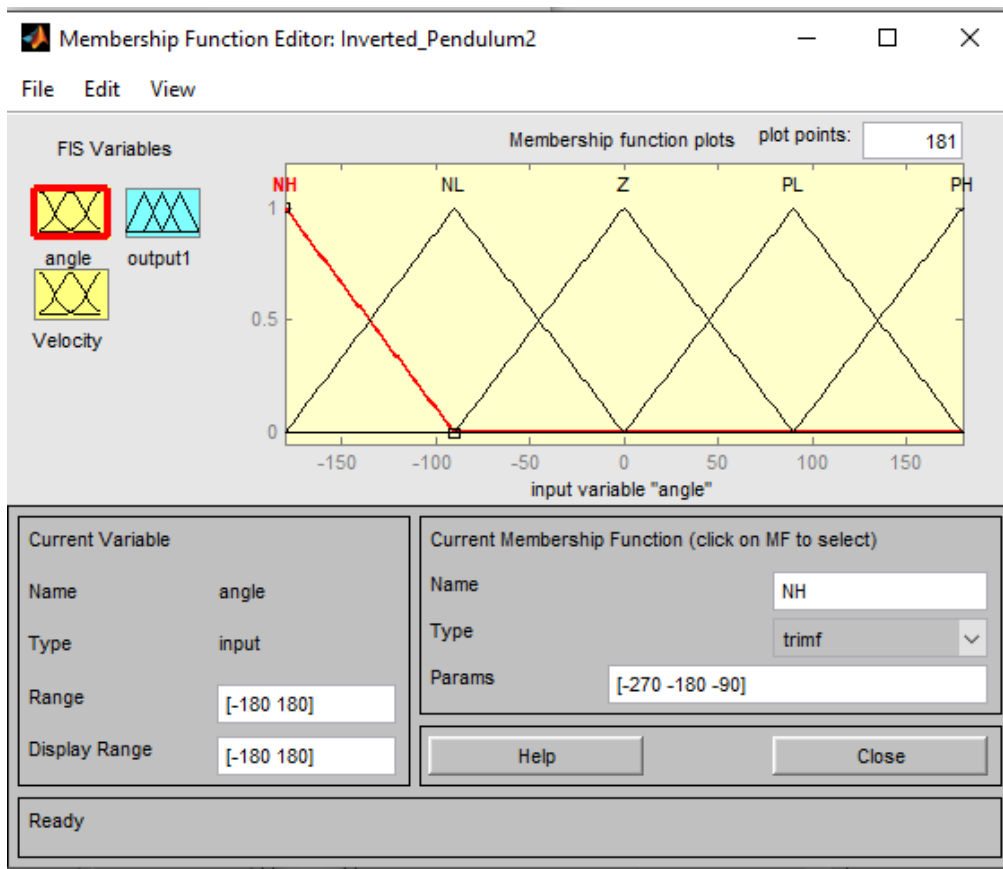
$$(0 * 0.3 + -1 * 0.45 + 1 * 0.1 + 0 * 0.15) / (0.3 + 0.45 + 0.1 + 0.15)$$

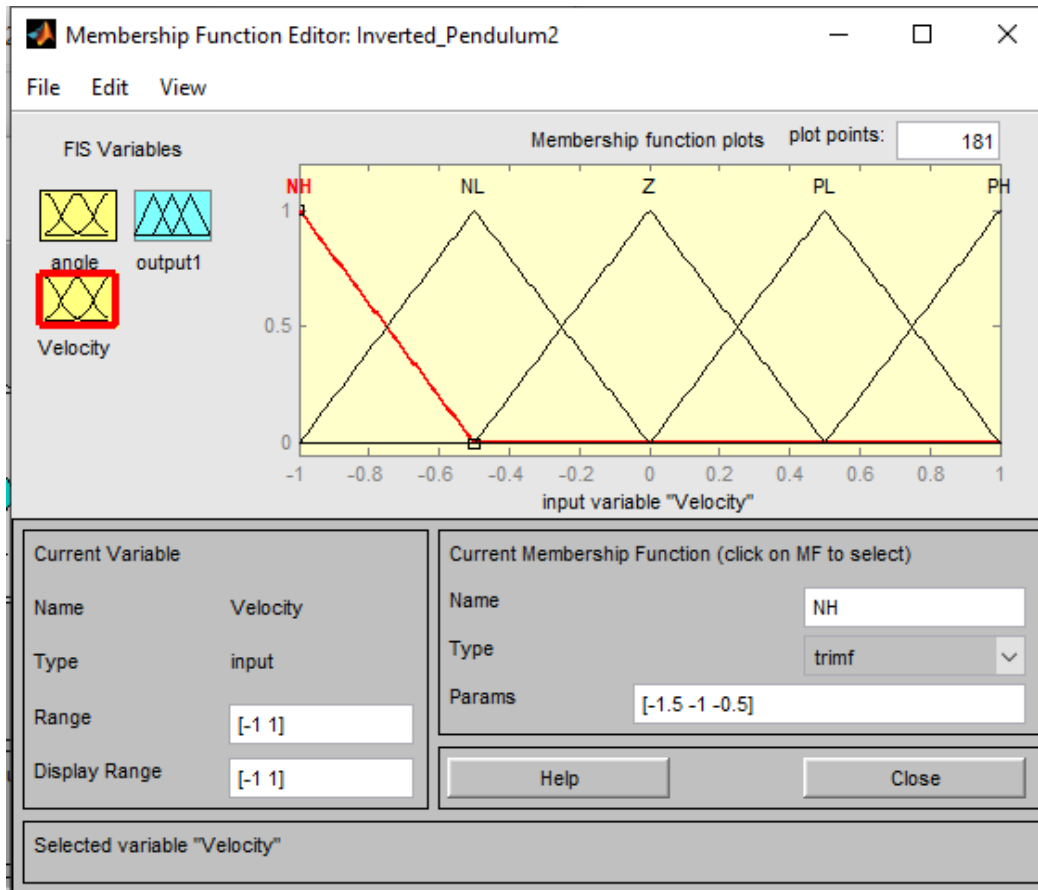
$$(-0.35) / (1.0)$$

$$= -0.35N$$

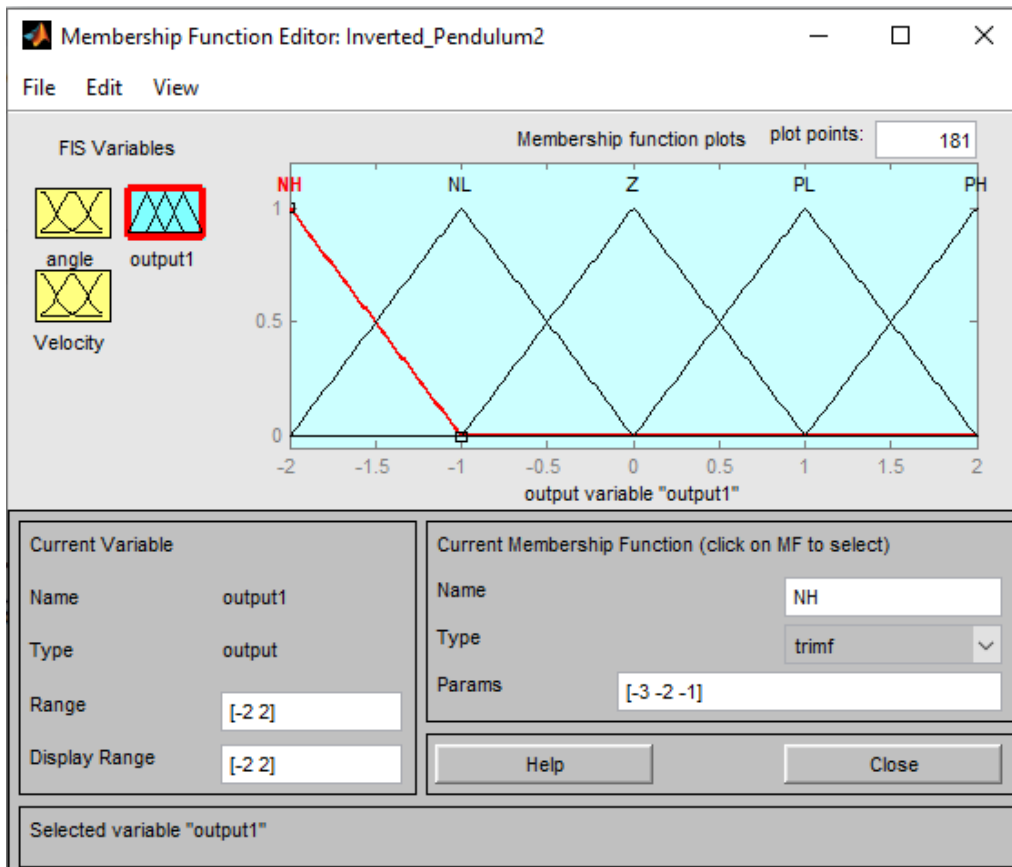
3.

Input Membership functions





Output Membership function



Rule Base

Rule Editor: Inverted_Pendulum2

File Edit View Options

1. If (angle is NH) and (Velocity is NH) then (output1 is NH) (1)
2. If (angle is NL) and (Velocity is NH) then (output1 is NH) (1)
3. If (angle is Z) and (Velocity is NH) then (output1 is NH) (1)
4. If (angle is NH) and (Velocity is NL) then (output1 is NH) (1)
5. If (angle is NH) and (Velocity is Z) then (output1 is NH) (1)
6. If (angle is NL) and (Velocity is NL) then (output1 is NH) (1)
7. If (angle is NH) and (Velocity is PL) then (output1 is NL) (1)
8. If (angle is NL) and (Velocity is Z) then (output1 is NL) (1)
9. If (angle is Z) and (Velocity is NL) then (output1 is NL) (1)
10. If (angle is PL) and (Velocity is NH) then (output1 is NL) (1)

If angle is and Velocity is Then output1 is

NH NL Z PL PH none not

Connection
☐ or
☒ and

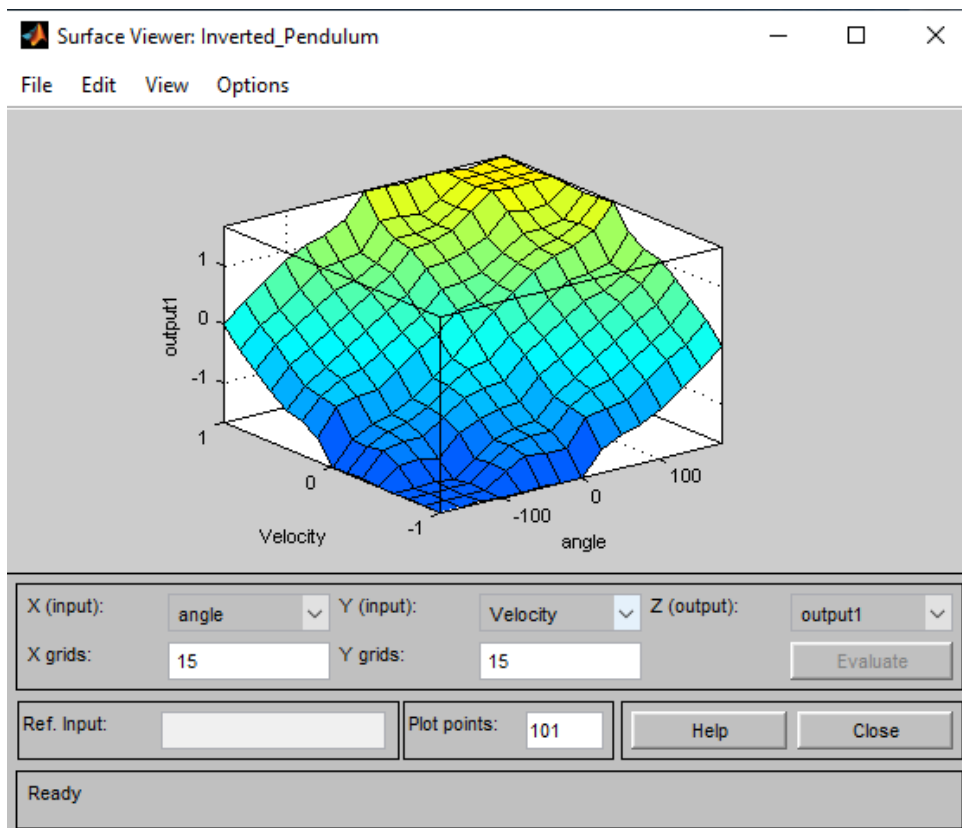
Weight: 1

Delete rule Add rule Change rule << >>

FIS Name: Inverted_Pendulum2

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Surface Map



MATLAB R2013a

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New Script New Open Find Files Compare Import Data Save Workspace Open Variable Clear Workspace Analyze Code Run and Time Clear Commands Simulink Library Layout Set Path Parallel Help Request Support Add-Ons

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Command Window

New to MATLAB? Watch this [Video](#), see [Examples](#), or read [Getting Started](#).

```
out =  
  
    0.3873  
  
>> fis = readfis('Inverted_Pendulum.fis')  
  
fis =  
  
    name: 'Inverted_Pendulum'  
    type: 'mamdani'  
    andMethod: 'min'  
    orMethod: 'max'  
    defuzzMethod: 'centroid'  
    impMethod: 'min'  
    aggMethod: 'max'  
    input: [1x2 struct]  
    output: [1x1 struct]  
    rule: [1x25 struct]  
  
>> out=evalfis([65 -0.1],fis)  
  
out =  
  
    0.3873  
  
>> surfview(fis)  
fx >>
```

Workspace

Name	Value
fis	<1x1 st
fis2	<1x1 st
out	0.3873

Command History

```
fis2 = readfis  
surfview(fis2)  
fis = readfis('Inverted_Pendulum.fis')  
surfview(fis)  
out=evalfis([65 -0.1],fis)  
fis2 = readfis  
out=evalfis([65 -0.1],fis)  
fis = readfis('Inverted_Pendulum.fis')  
out=evalfis([65 -0.1],fis)  
surfview(fis)
```