

A decorative graphic on the left side of the slide. It features a vertical orange line on the far left, followed by a grey textured vertical bar, another vertical orange line, and a cluster of five orange circles of varying sizes. The largest circle is at the top left of the cluster, with four smaller circles of decreasing size arranged in a descending pattern to its right and bottom.

FUZZY LOGIC

OVERVIEW

- What is Fuzzy Logic?
- Where did it begin?
- Fuzzy Logic vs. Neural Networks
- Fuzzy Logic in Control Systems
- Fuzzy Logic in Other Fields
- Future

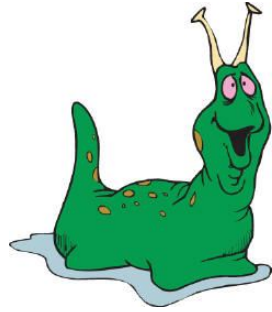


WHAT IS FUZZY LOGIC?

- Definition of fuzzy
 - Fuzzy – “not clear, distinct, or precise; blurred”
- Definition of fuzzy logic
 - A form of knowledge representation suitable for notions that cannot be defined precisely, but which depend upon their contexts.



TRADITIONAL REPRESENTATION OF LOGIC



Slow

Speed = 0



Fast

Speed = 1

```
bool speed;  
get the speed  
if ( speed == 0) {  
  // speed is slow  
}  
else {  
  // speed is fast  
}
```



FUZZY LOGIC REPRESENTATION

- For every problem must represent in terms of fuzzy sets.



Slowest

[0.0 – 0.25]



Slow

[0.25 – 0.50]



Fast

[0.50 – 0.75]

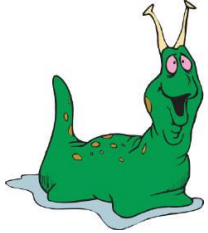


Fastest

[0.75 – 1.00]



FUZZY LOGIC REPRESENTATION CONT.



Slowest

Slow

Fast

Fastest

```
float speed;  
get the speed  
if ((speed >= 0.0)&&(speed < 0.25)) {  
    // speed is slowest  
}  
else if ((speed >= 0.25)&&(speed < 0.5))  
{  
    // speed is slow  
}  
else if ((speed >= 0.5)&&(speed < 0.75))  
{  
    // speed is fast  
}  
else // speed >= 0.75 && speed < 1.0  
{  
    // speed is fastest  
}
```



ORIGINS OF FUZZY LOGIC

- Traces back to Ancient Greece
- Lotfi Asker Zadeh (1965)
 - First to publish ideas of fuzzy logic.
- Professor Toshire Terano (1972)
 - Organized the world's first working group on fuzzy systems.
- F.L. Smidth & Co. (1980)
 - First to market fuzzy expert systems.



FUZZY LOGIC VS. NEURAL NETWORKS

- How does a Neural Network work?
- Both model the human brain.
 - Fuzzy Logic
 - Neural Networks
- Both used to create behavioral systems.

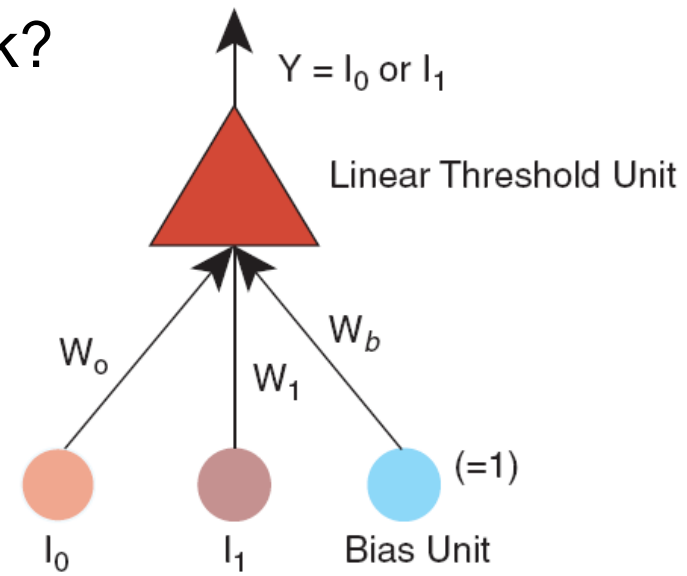


Fig. 2 A simple, single-unit adaptive network



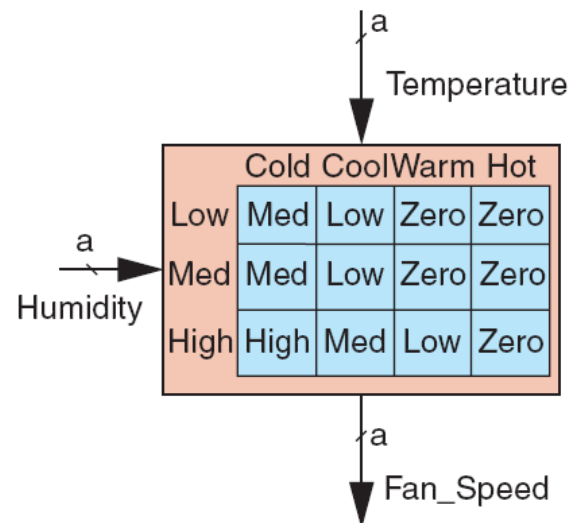
FUZZY LOGIC IN CONTROL SYSTEMS

- Fuzzy Logic provides a more efficient and resourceful way to solve Control Systems.
- Some Examples
 - Temperature Controller
 - Anti – Lock Break System (ABS)

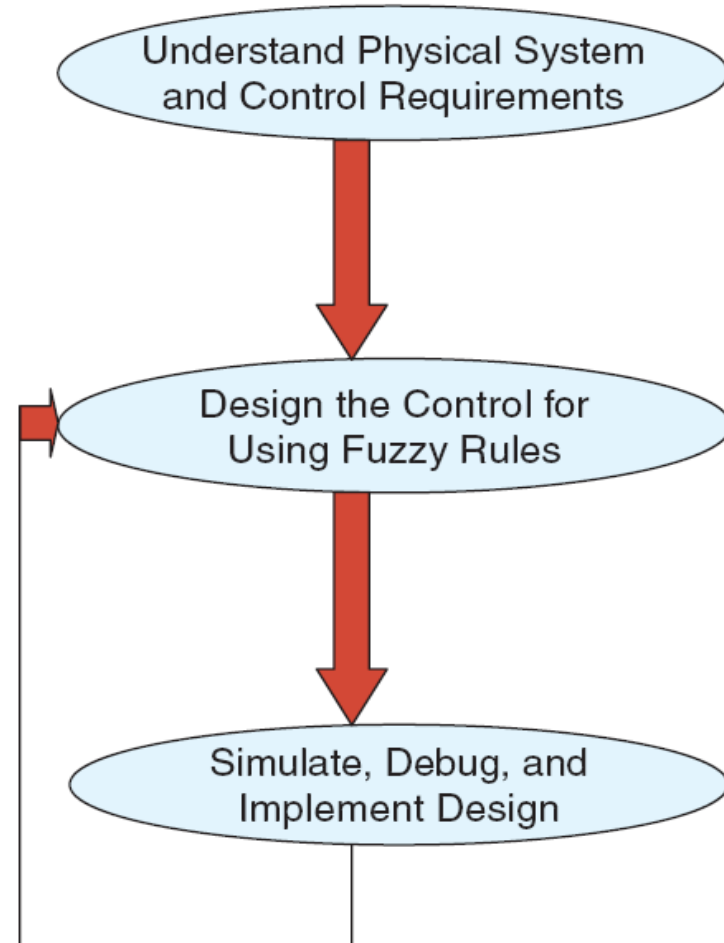
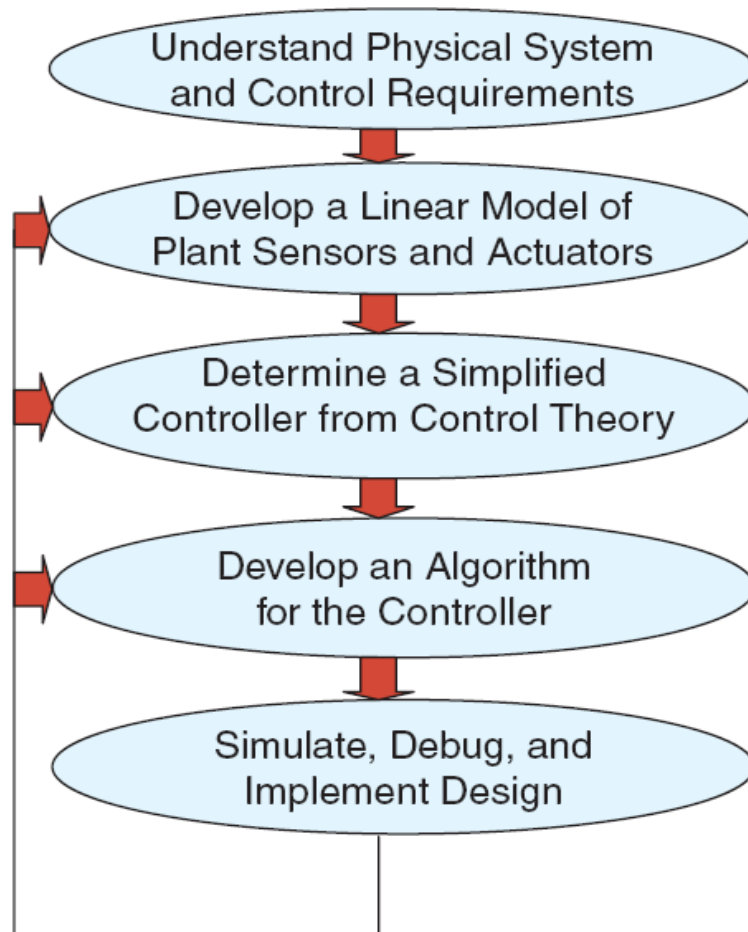


TEMPERATURE CONTROLLER

- The problem
 - Change the speed of a heater fan, based off the room temperature and humidity.
- A temperature control system has four settings
 - Cold, Cool, Warm, and Hot
- Humidity can be defined by:
 - Low, Medium, and High
- Using this we can define the fuzzy set.



BENEFITS OF USING FUZZY LOGIC



ANTI LOCK BREAK SYSTEM (ABS)

- Nonlinear and dynamic in nature
- Inputs for Intel Fuzzy ABS are derived from
 - Brake
 - 4 WD
 - Feedback
 - Wheel speed
 - Ignition
- Outputs
 - Pulsewidth
 - Error lamp

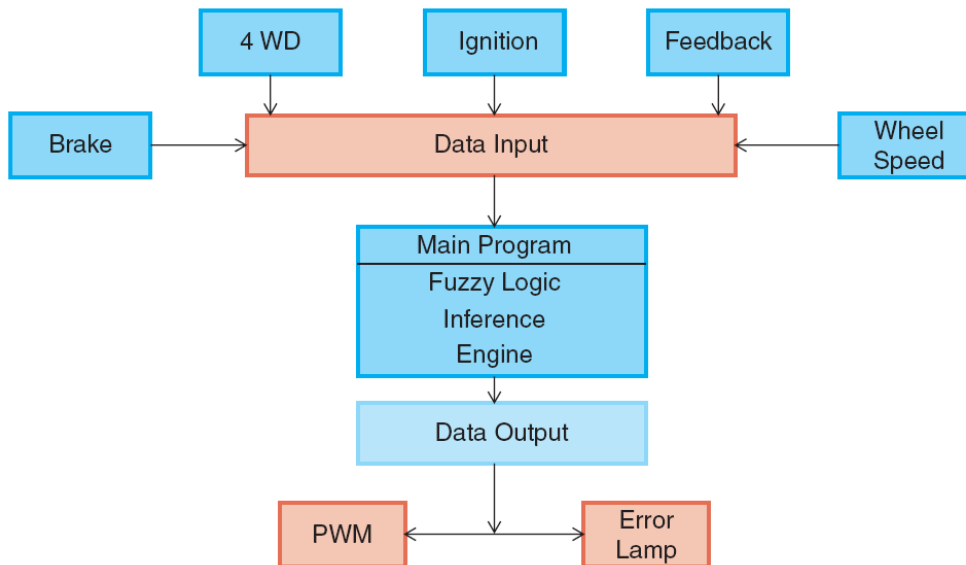


Fig. 6 ABS block diagram



FUZZY LOGIC IN OTHER FIELDS

- Business
- Hybrid Modeling
- Expert Systems



CONCLUSION

- Fuzzy logic provides an alternative way to represent linguistic and subjective attributes of the real world in computing.
- It is able to be applied to control systems and other applications in order to improve the efficiency and simplicity of the design process.

