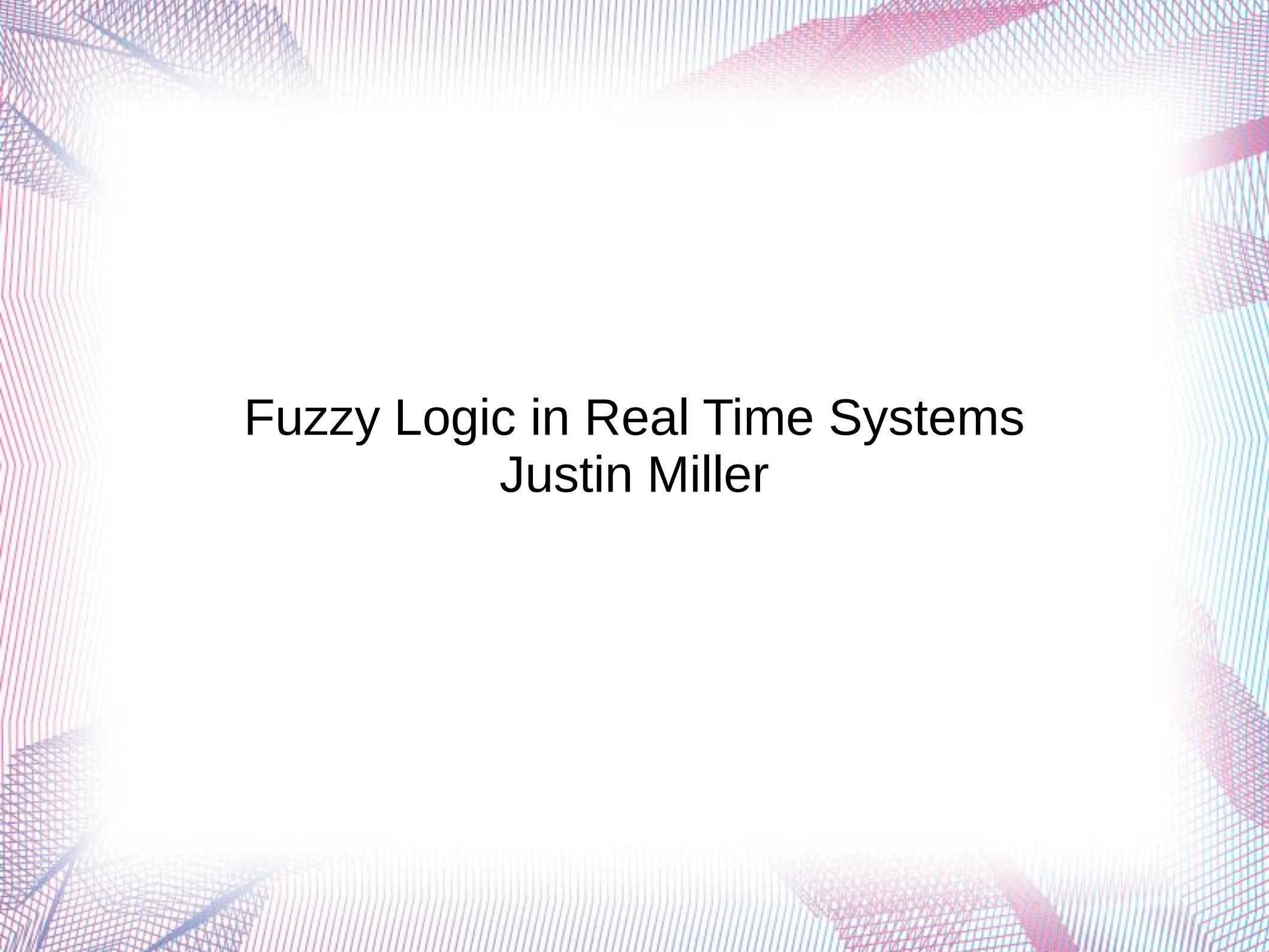




Fuzzy Logic in Real Time Systems

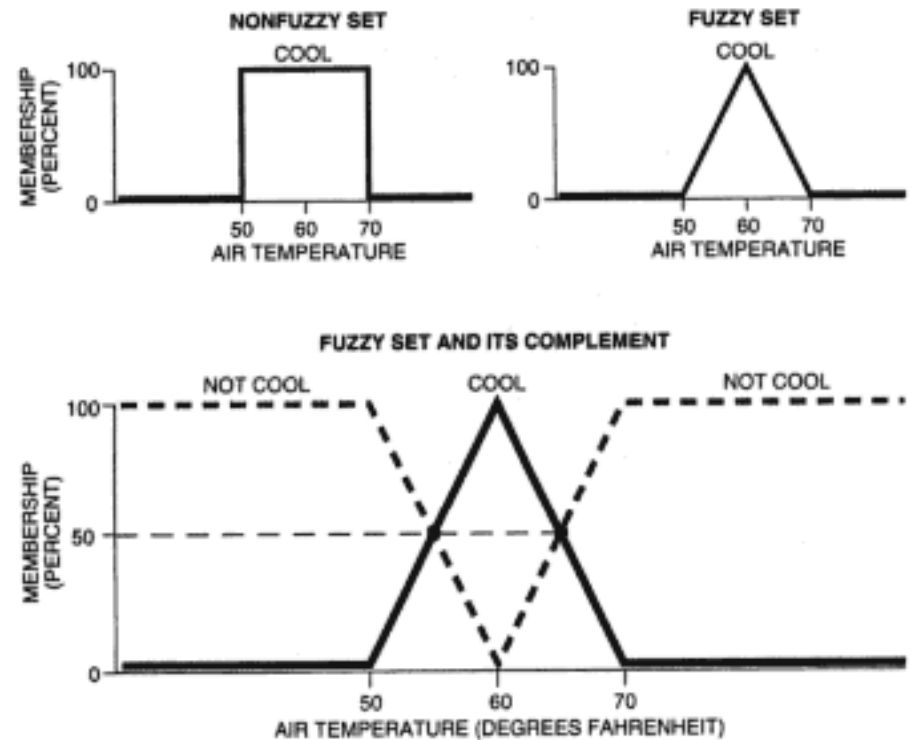
Justin Miller

What is Fuzzy Logic?

- Fuzzy logic != Imprecise logic
- Allows computers to understand imprecise things
 - “Warm”, “Cool”
 - “Too Fast”, “Too Slow”
- Encode commonsense rules, when there isn't a specific algorithm

What is a Fuzzy Set?[1]

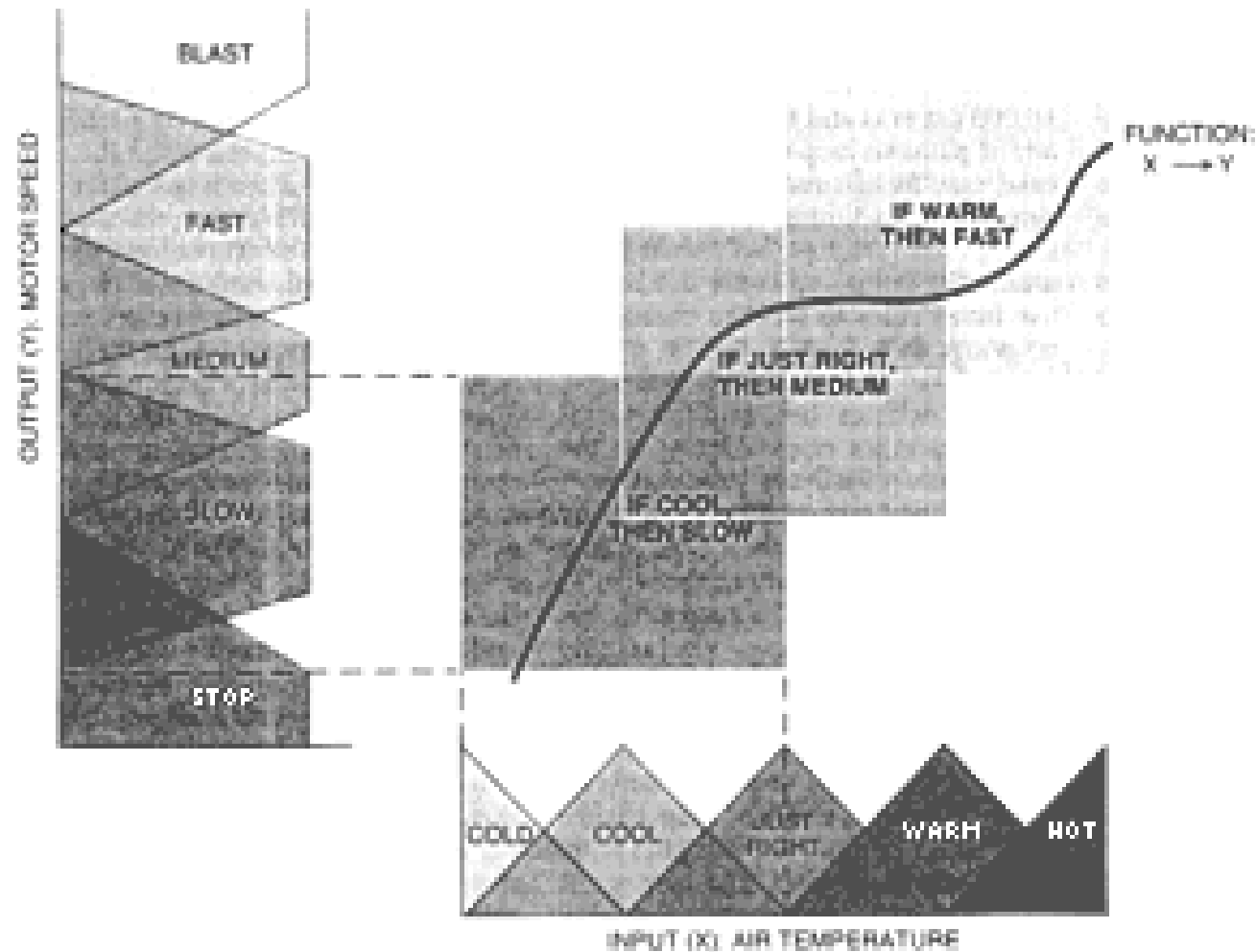
- Common sets are bivalent
- Fuzzy sets are multivalent
- Fuzzy sets do not talk about probability
- Accounts for an issue in set theory



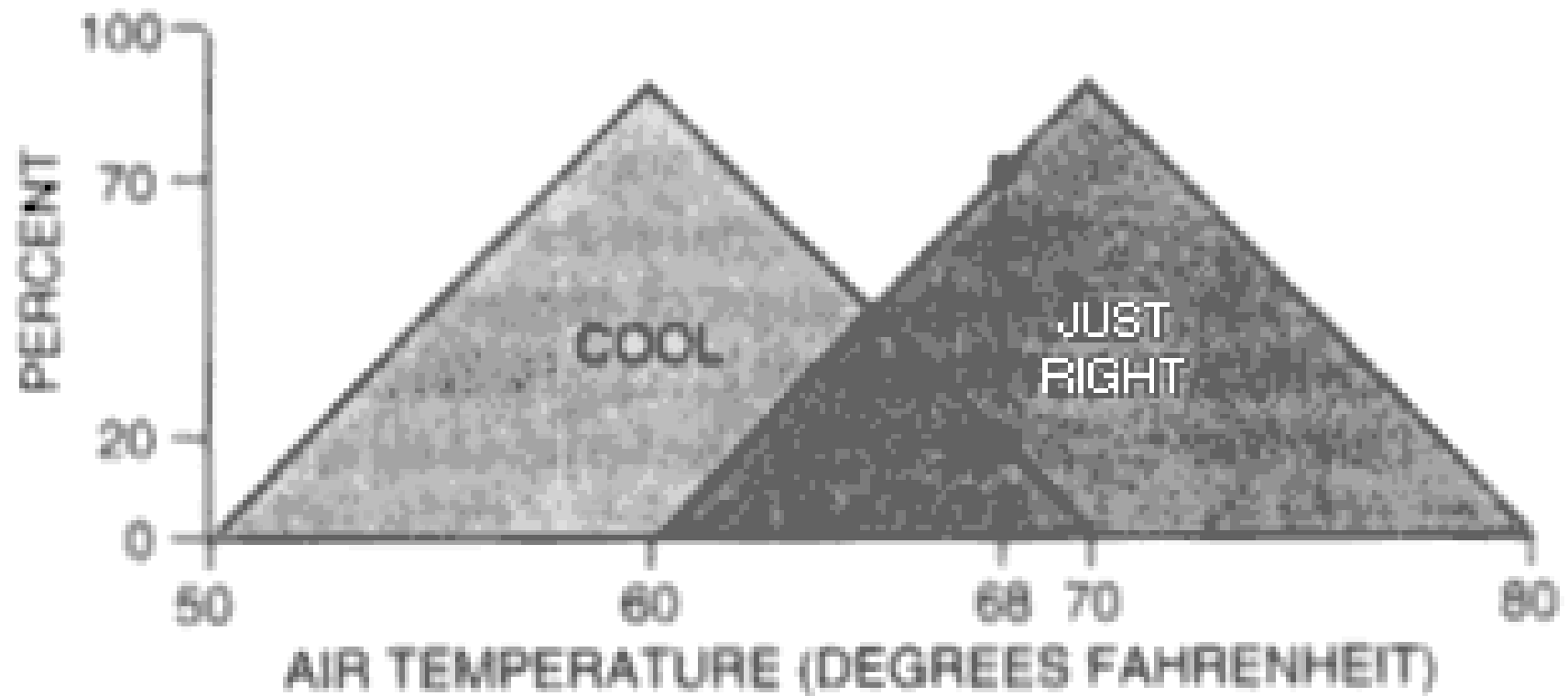
How Does Fuzzy Sets and Fuzzy Logic Work?[2]

- Fuzzy Logic is composed of rules that fire when certain conditions are met
- Fuzzification → Fuzzy Reasoning → Defuzzification

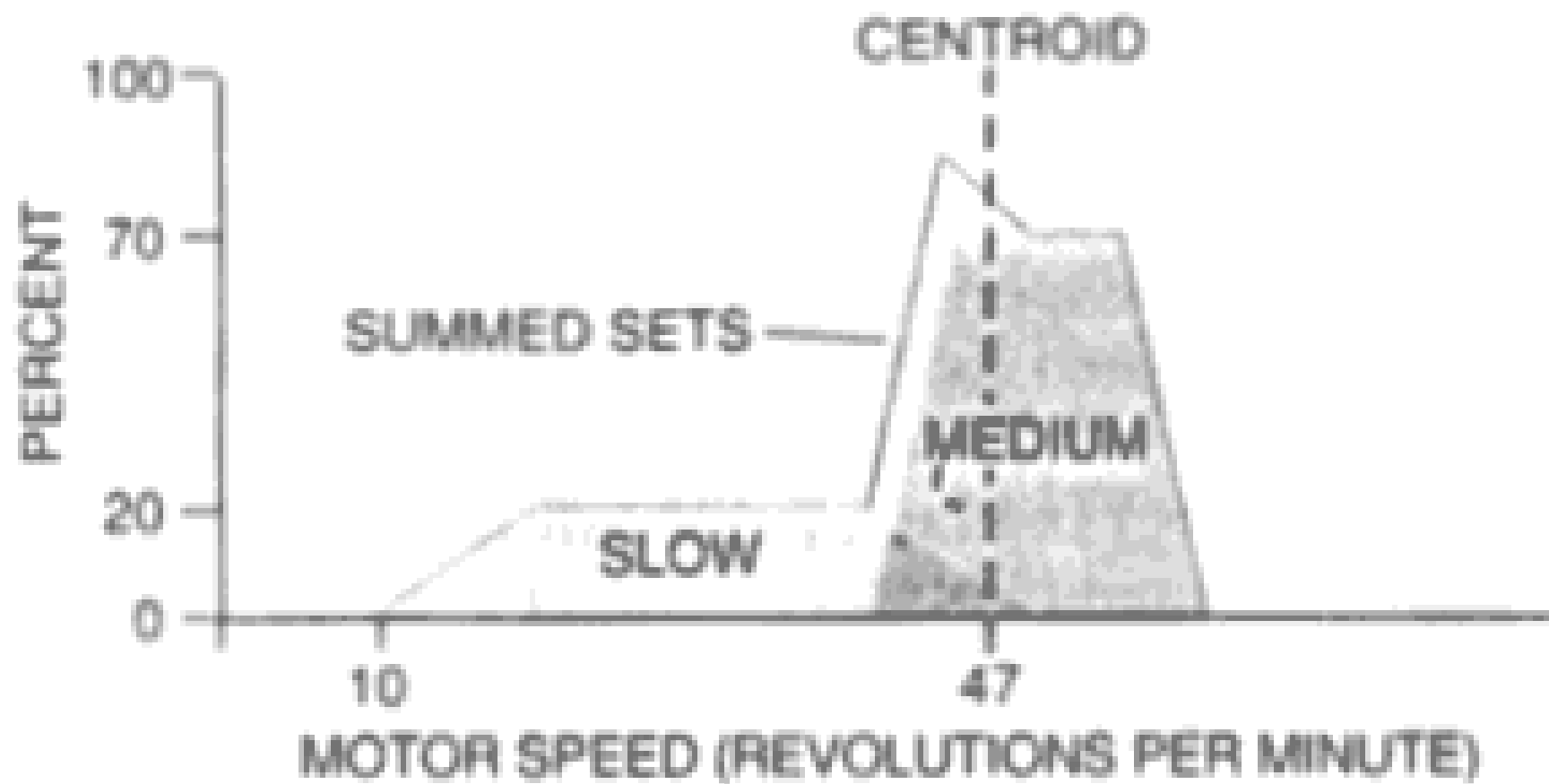
Example Rules[1]



Example Temperature[1]



Example Defuzzification[1]



Visual Aid for Fuzzy Logic

- <http://video.google.com/videosearch?hl=en&source=hp&q=fuzzy%20logic%20reverse%20pendulum&um=1&ie=UTF-8&sa=N&tab=wv#q=fuzzy+logic+inverted+pendulum&hl=en&emb=0>

Classic Example: Sendai Subway Line[3,4,6]

- Installed in 1987 by the Hitachi Corporation
- 14.8 km long with 17 stations
- During peak hours, trains are ran automatically using fuzzy logic
- More efficient and better than human conductors

Other Examples[1,3,5,7]

- Nissan's auto transmission
- Nissan's antiskid brakes
- Yamaichi Securities's stock market shift detection
- Canon's auto-focus camera
- HVAC systems
- MASSIVE 3D animation system (LoTR)
- Breast cancer detection
- Nuclear reactors (MIT, FUGEN, BR1, TRIGA Mark III)

Resources

- [1]<http://www.his.se/PageFiles/10256/An%20introduction%20to%20fuzzy%20logic%20by%20Kosko%20and%20Isaka.pdf?epslanguage=sv>
- [2]<http://ii.fmph.uniba.sk/~farkas/Courses/Complnt/References/ying.fuzzy.ieee00.pdf>
- [3]<http://www.time.com/time/magazine/article/0,9171,958640,00.html>
- [4]<http://www.applet-magic.com/fuzzyjapan.htm>
- [5]<http://www.calvin.edu/~pribeiro/othrlnks/Fuzzy/apps.htm>
- [6]http://en.allexperts.com/e/s/se/sendai_city_subway_line.htm
- [7]<http://iospress.metapress.com/content/2xxv25224qhwywbe/>