



Aalto University

AS-0.3200 Automaatio- ja systemitekniikan projektityöt

S13-11 Design Of A Fuzzy Controller For Inverted
Pendulum

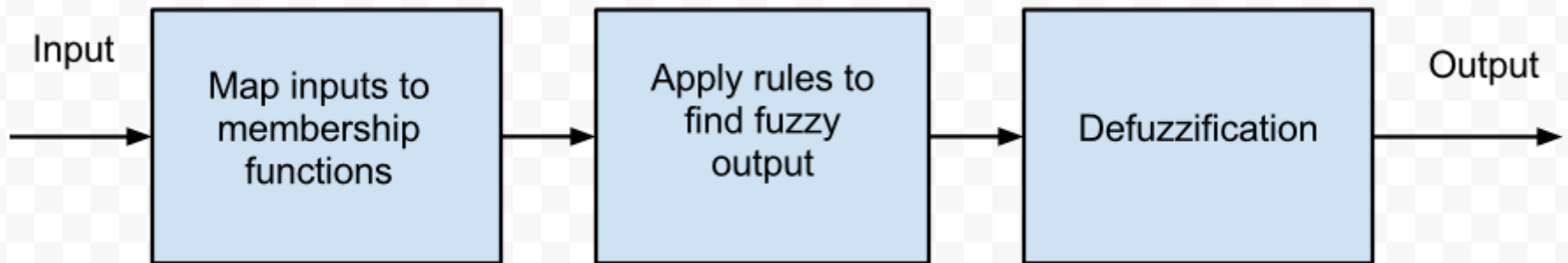
Otso Mäki

Vesa Nikkilä

Sami El-Madhoun

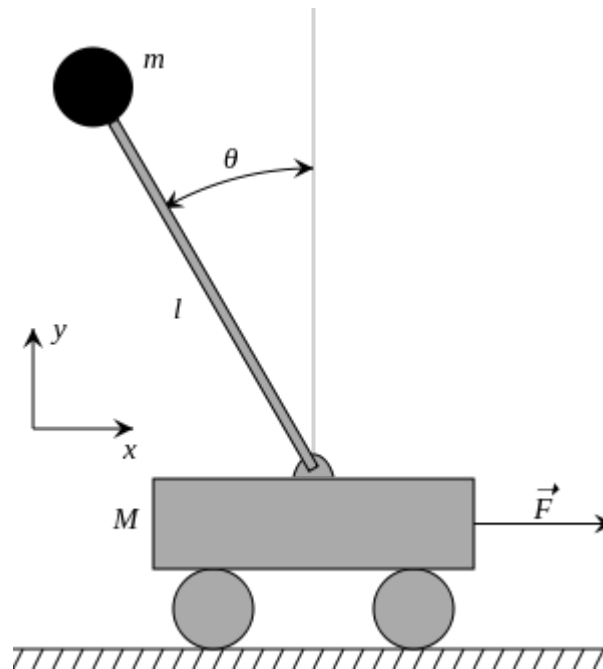
Fuzzy Controller

- Fuzzy controller can be divided into three parts



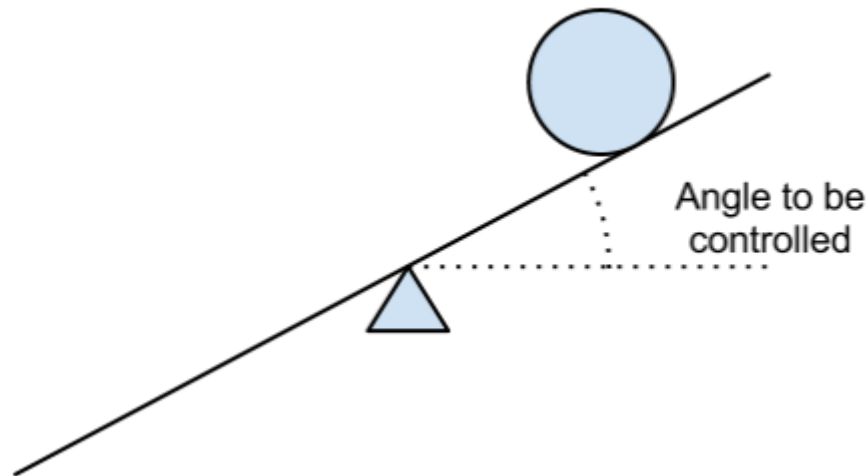
Inverted Pendulum

- Balance the pendulum controlling the force applied F
- Only necessary to control the angle of the pendulum



Ball And Beam

- Goal is to keep the ball at the origin
- System input is the angular acceleration



Project Structure

1. Revision of fuzzy control theory
2. Designing the structure of the control algorithm
 - i. Identify the inputs and outputs of the overall function and determine their formats
 - ii. Find what are the inputs and outputs for fuzzification, decision making and defuzzification
 - iii. Determine the main computational problems in each of these functions

Project Structure

3. Create Simulink models for the inverted pendulum and the ball and beam system
 4. Implement the algorithm and compare it to Matlab's implementation of fuzzy control
 5. Tune the controller for both control problems
 - i. Determine the number of membership functions for both input and output
 - ii. Decide the shape of membership functions (triangular, Gaussian,...)
 - iii. Determine the rules for decision making
 6. Final Documentation
-



Risk Management

Risk	How it can be avoided
Insufficient time	Everyone makes sure that other members keep up to the agreed timetable
Getting stuck at creating some part of the algorithm	Keep the code modular so that multiple sections of the code can be implemented simultaneously.
Group member becomes sick or is absent	Flexible planning. All group members know each others tasks and can fill in.