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Simulation of Fuzzy Modeling of Human Control Strategy for Overhead Crane using MATLAB.

[1]Rajeev, [2]Pawan Kumar Pandey and
[3]Disha Popli

[1]Research Scholar, [2]Faculty Member, [3]Research Scholar
EEE Department, BRCMCET, Bahal, Bhiwani, Haryana-127028, India
E-mail: rajeevchugh@live.com, pkpnitj@gmail.com,
punjabikudidisha@gmail.com

Abstract

The overhead cranes are being used frequently by modern industries and hence the problem of controlling has attracted the interest from both practical research works as well as from academic. The objective of controlling is to move the load to the desired point with minimum swing of load so that it can be derived to that point in minimum time. Earlier the system was developed using linear control theory which is simple and easy to operate but in that kind of system significant errors start developing over a period of time with change in parameters. We can also say that those kinds of systems are very sensitive to change in parameters. To overcome these shortcomings fuzzy based control of the overhead cranes has been introduced in recent decades. These methodologies have helped achieving better response characteristics.

It is known that fuzzy control rules for a control system are built by designers with trial and error and based on their experience on some preliminary experiments.

Keywords: Overhead, Fuzzy Logic, membership function, De-fuzzification

Objective
The existing model of fuzzy based crane controller is a two inputs and one output system. The two input variables are Swing angle and Distance of the container from the Truck. The output variable is Power to crane. The limitation of this system is that there is no provision to control the Rope length, Rate of change of swing angle and X-Y position of the object.

In my paper a 5 inputs single output model has been proposed in which Rope length, Rate of change of swing angle and X-Y position of the object will also be considered as inputs along with the Swing angle and Distance of the container from the Truck.

The output variable will remain the same i.e. Power to crane.

Methodology:

MAMDANI structure of fuzzy logic will be used to construct the 5 inputs and single output model.

Tools:

After the structure gets constructed the MATLAB FUZZY TOOLBOX will be used for simulating the rule-base.

Modeling & Simulation Results:

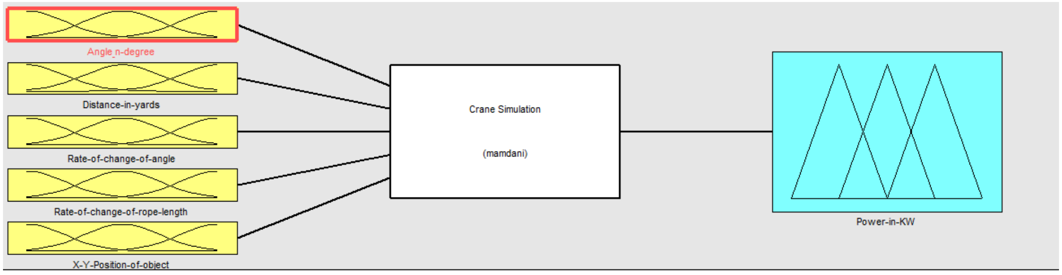

Figure 1: System Structure

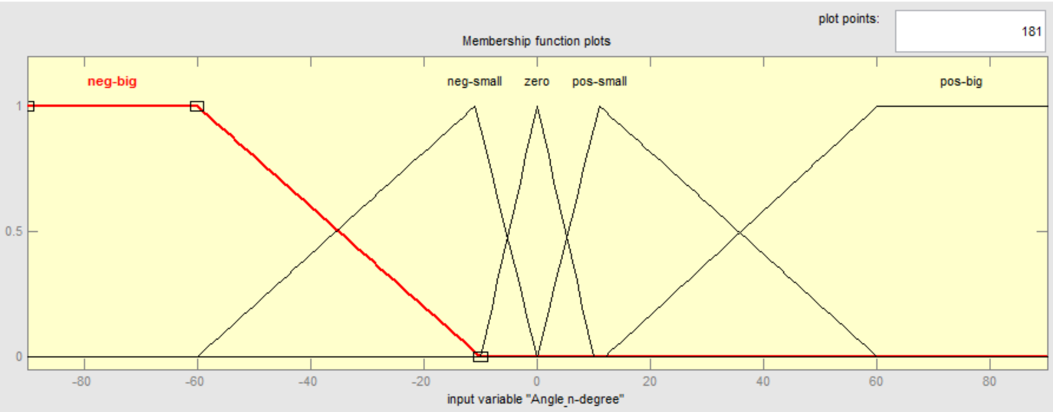

Figure 2: Membership Function For input variable 1

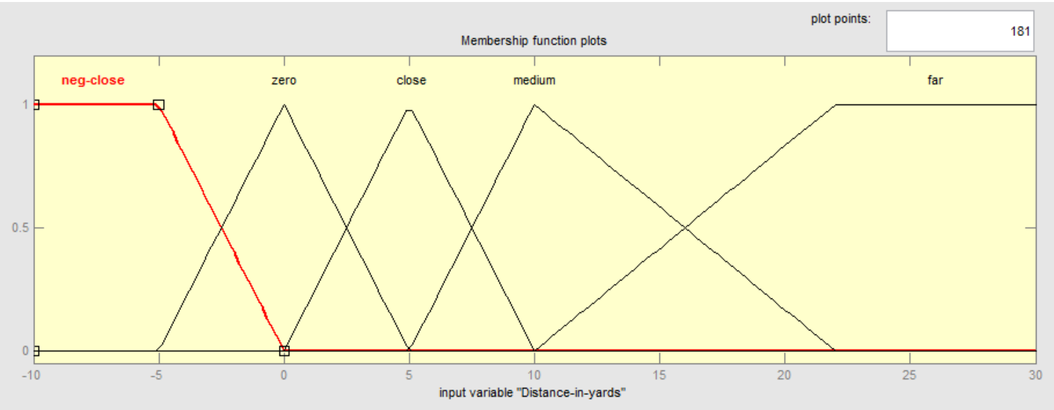

Figure 3: Membership Function For input variable 2

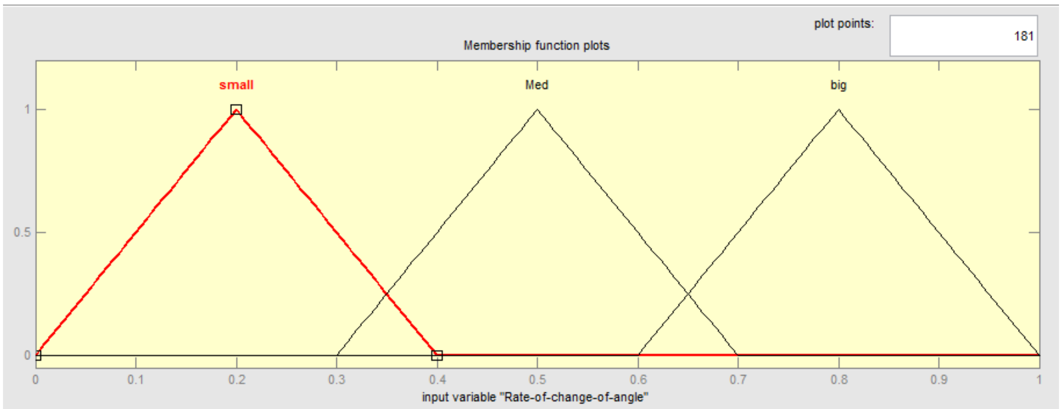

Figure 4: Membership Function For input variable 3

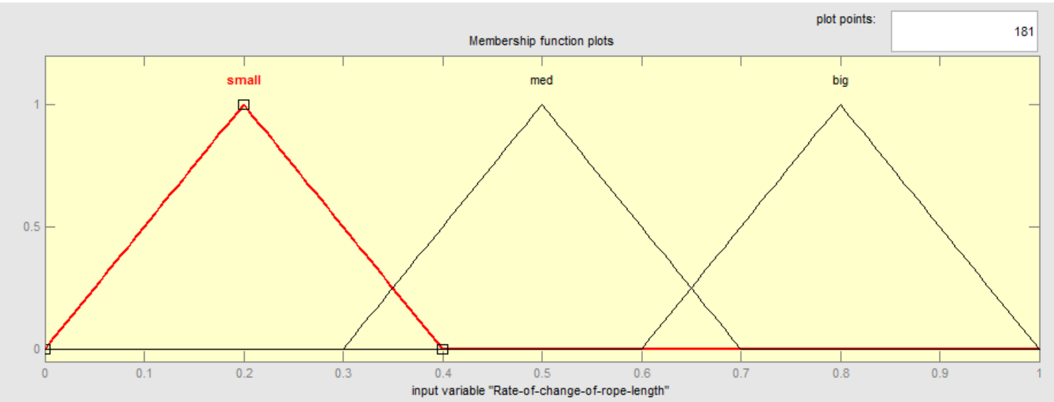

Figure 5: Membership Function For input variable 4

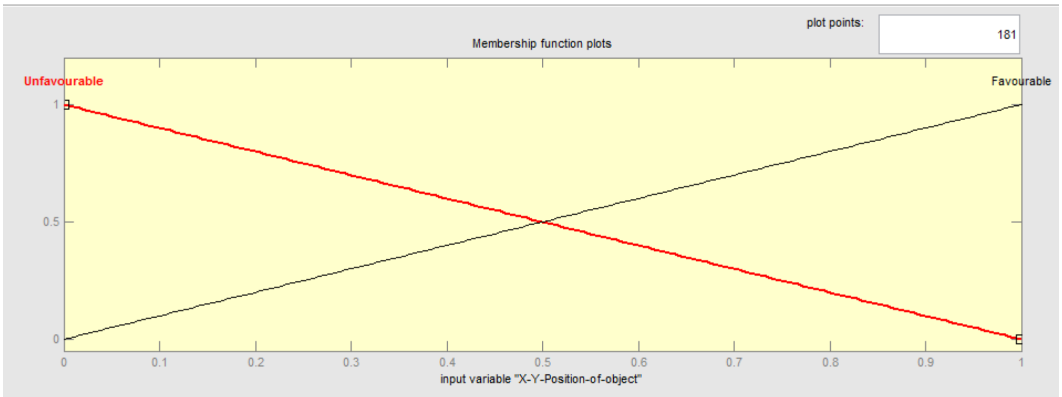

Figure 6: Membership Function For input variable 5

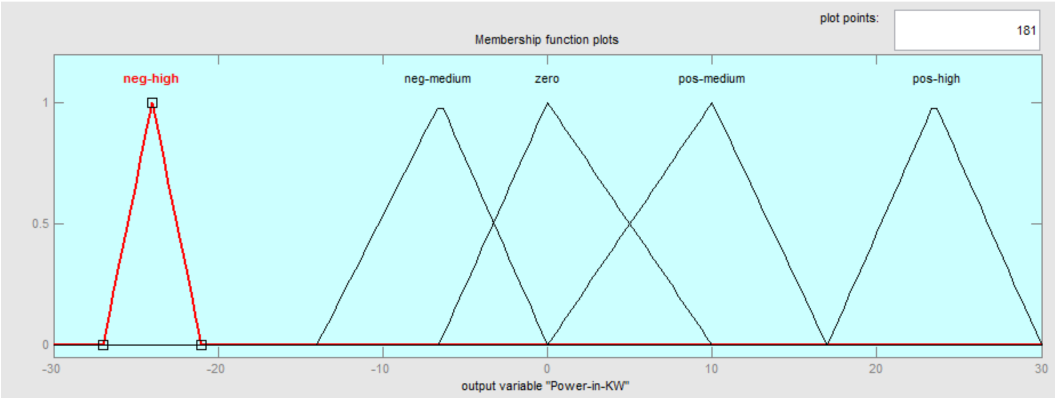

Figure 7: Membership Function For output variable 1

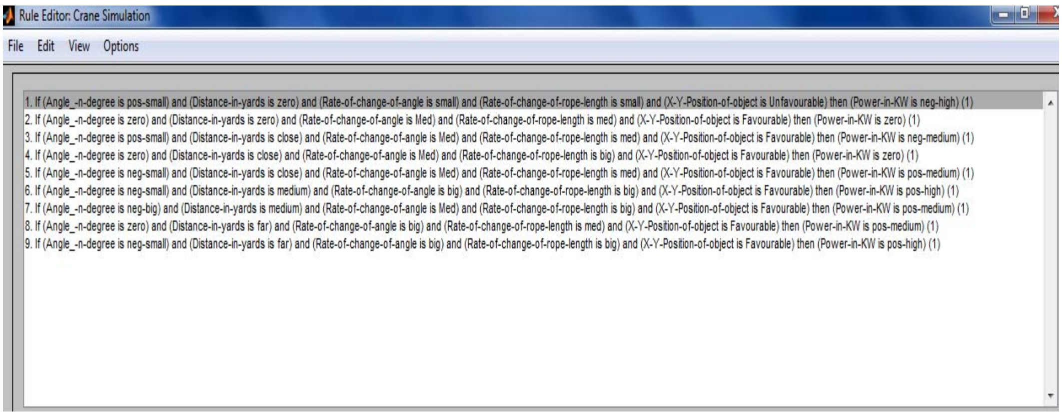

Figure 8: Rule Base

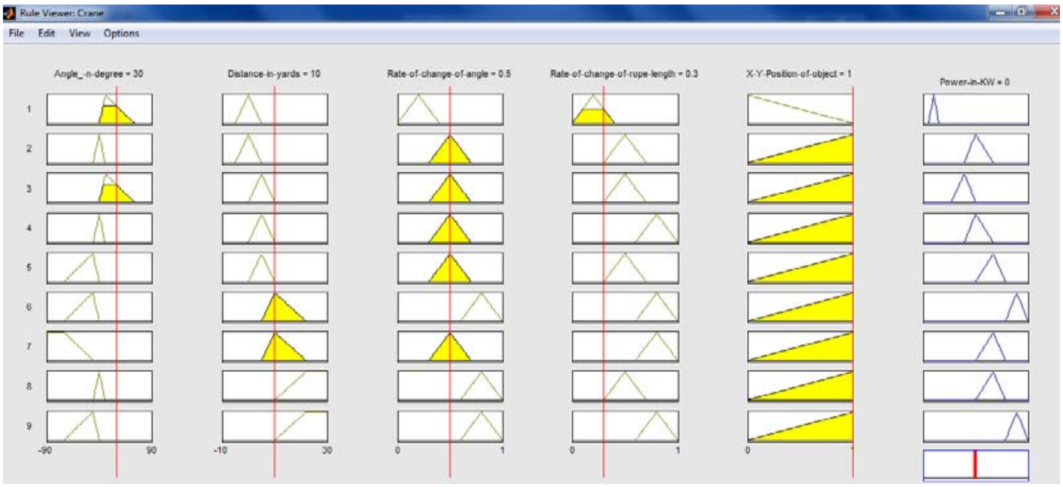

Figure 9: Rule Viewers

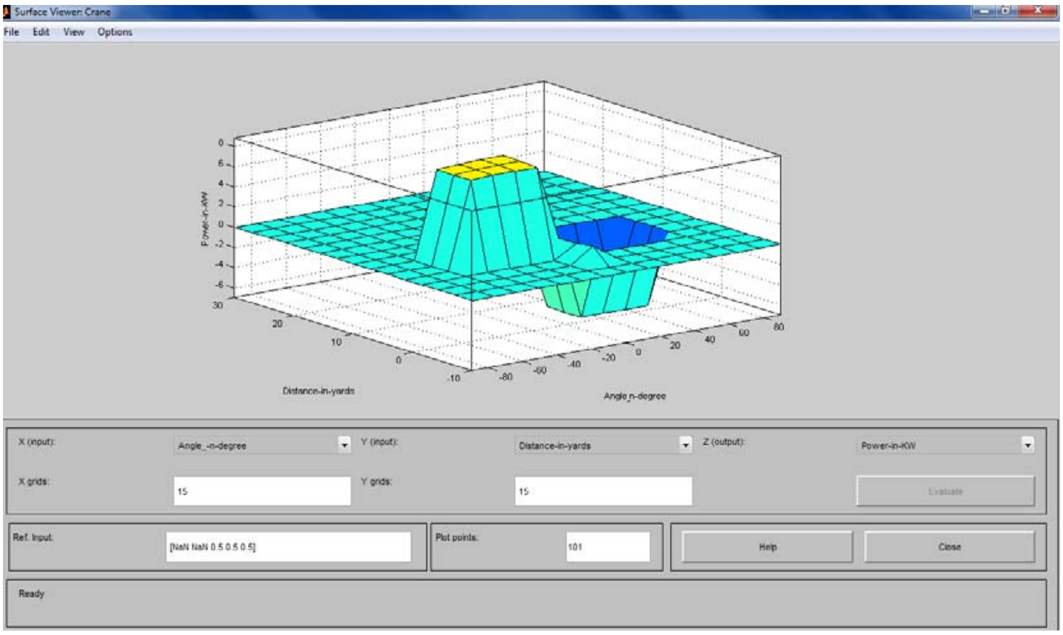

Figure 10: Surface Viewers

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